Health Consultation

HARPETH RIVER SITE

COLLEGE GROVE, WILLIAMSON COUNTY, TENNESSEE

CERCLIS NO. TND004048690

MARCH 14, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

HARPETH RIVER SITE

COLLEGE GROVE, WILLIAMSON COUNTY, TENNESSEE

CERCLIS NO. TND004048690

Prepared by:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

The U.S. Environmental Protection Agency (EPA) Region IV requested the Agency for Toxic Substances and Disease Registry (ATSDR) to review the results of environmental samples (surface water, subsurface soil, and sediment samples) obtained from Harpeth River and areas near the river, and indicate if the levels of contaminants pose a public health hazard. **This public health consultation supersedes the previous public health consultation prepared for this site on December 23, 1999.**

The Harpeth River is located near College Grove, Tennessee. It is adjacent to the General Smelting and Refining, Inc., site, which is a secondary smelting facility in operation since 1953. General Smelting and Refining Inc., site is fenced and is located about 1.5 miles northeast of College Grove.

In 1998, every quarter, EPA collected one surface water sample from the middle of the stream along Harpeth River at both upstream and downstream locations and from a storm water outfall area. These surface water samples were collected during storm events and during normal flow events. The samples obtained from the storm water outfall area were taken prior to the storm water entering the river from General Smelting. Sampling site 1 was located about 1 mile upstream and sampling site 2 was located immediately (400 feet) downstream from the General Smelting Refining Inc.

Eight surface soil (0 - 12 inches) and two subsurface soil (greater than 12 inches below surface) samples were collected on July 8, 1998, from different sampling locations along the river (see Table 1 for results). Also, nine sediment samples were collected from the banks along a 1 mile stretch of Harpeth River at both upstream and downstream locations. The base of the river is bedrock [1], therefore, there should be limited sediments in the river. The sediment samples were collected during two flow regimes i.e., during November through April (high flow) and from May through October (low flow). All samples were analyzed for antimony, arsenic, cadmium, lead and zinc. See Table 2 for sediment sampling results and Attachment 1 for surface water sampling results.

Prior to the enforcement of the Clean Water Act, the standard operating procedure for the secondary lead smelting operations allowed waste streams, which included lead contaminated spent battery acid, to flow untreated into the Harpeth River. Indiscriminate disposal of battery casings in and around the facility may have contributed another source of lead contamination to the river. Other possible sources of lead contamination may have been emissions from the smelting operations and the furnace slag deposited in landfills are spread as backfill. The river cuts through banks of an old landfill on the site, which may be another source of metal contamination. Currently, the site is being remediated under a Resource Consevation Recovery

Act (RCRA) permit. This remedial action is in response to an order issued by the state of Tennessee Department of Environmental and Conservation Division (TDEC) of Water Pollution Control on October 2, 1997. Recently, EPA and TDEC approved General Smelting and Refining's stabilization plan, which was developed to remediate the highest levels of lead detected along the river banks. During the stabilization process, contaminated soils will be removed from the riverbank.

On August 23 and 24, 1999, the Tennessee Department of Health conducted an exposure investigation near the site. They tested 32 children, who were 14 months to 6 years old, 59 children, who were 7 years to 18 years old, 3 men, and 56 women of child bearing age. They determined that out of the 159 blood samples collected that no blood lead levels exceeded 10 micrograms per deciliter (µg/dl) [2].

On January 25, 2000, EPA and TDEC indicated that the contaminated areas have limited assess, because of the highly vegetated steep banks along the river [3]. A video tape of the sampled area of Harpeth River was used to provide insight on exposure scenarios at this site.

Table 1. Soil Contaminants Concentration Range Detected at Harpeth River

	Surface Soil Samples	Subsurface Soil Samples
Antimony	2.6 - 92	1.1 - 1.8
Arsenic	5.8 - 120	7.1 - 7.9
Barium	140 - 440	140 - 180
Berylium	ND - 4.1	ND - 1.8
Chromium	22 - 38	19 - 27
Manganese	1,200 - 2,000	1,300
Mercury	ND - 0.05	ND
Nickel	11 - 39	ND - 14
Lead	140 - 7,000	140 - 850

All values are expressed as parts per million (ppm).
ND = None Detect

Table 2. Summary of Sediment Results for Metals at Harpeth River

	Minimum* concentration (ppm)	Maximum* concentration (ppm)	Number of samples where the metal was detected	Background information for the contaminant in soil in the Eastern United States†		Environmental media evaluation guidelines (EMEGs) for soil in ppm	
				Arithmetic mean (ppm)	Maximum (ppm)	child	adult
Antimony	5.1	66	7	0.48‡	8.8‡	20	300
Arsenic	18	61	8	7.4	73	20	200
Barium	200	580	8	420	1500	4000	50000
Beryllium	2.9	6.4	8	0.85	7	100	1000
Cadmium	1.9	20	1	0.25§	NA	50	700
Chromium	19	59	8	52	1000	200	2000
Lead	56	11,000	9	17	300	NA	NA
Manganese	1,200	7,800	8	640	7000	7000	100000
Mercury	0	0	8	0.12	3.4	20	200

†Source: ATSDR public health assessment guidance except where noted
‡ATSDR Toxicological Profile for Antimony
‖Quantity reported is uncertain
§ATSDR Toxicological Profile for Cadmium
NA = not available
ppm = parts per million

EMEG = ATSDR's Environmental Media Exposure Guide

Discussion

Although the results of soil samples and sediment samples obtained from the river banks at this site showed high levels of contaminants, they do not pose a health hazard, because the media are not accessible for people to come into contact with. The subsurface soil contaminants are below surface, and the river banks are very steep in certain areas and are highly vegetated, which prevents human contact with the surface soil. The results of surface water samples obtained from Harpeth River indicated that low levels of contamination exist, but the levels are not of health concern. After observing a video tape of the contaminated area and considering EPA and TDEC's

comments that the river banks are steep and heavily vegetated, it seems unlikely that exposure could occur at this site, because the contaminated areas are inaccessible. Furthermore, the river's surface water is difficult to assess, and it appears in palatable or disagreeable for swimming and it is unlikely that anyone would swim in it.

ATSDR Child Health Initiative

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children must be recognized and considered in any analysis of adverse health effects of communities impacted by contamination of hazardous substances. At this site, exposure to contaminants along the river banks is unlikely, and the river is not easily accessible.

Conclusions

Based on the data reviewed, ATSDR concluded that:

- It is unlikely that direct human contact to contaminants in surface, subsurface soils, and sediments would occur at this site, because the soil contaminants are along steep river banks, which are highly vegetated;

- Also, the low levels of contaminants detected in Harpeth River's surface water do not pose a health hazard to anyone who accesses the river.

Recommendations

None

Prepared by:

Robert L. Williams, Ph.D.
Environmental Toxicologist
Exposure Investigations and Consultation Branch
Division of Health Assessment and Consultation

Reviewed by:

Susan Moore
Chief, Consultations Section
Exposure Investigations and Consultations Branch
Division of Health Assessment and Consultations

References

1. Water and sediment survey of the Harpeth River Near RM 110.3 College Grove, TN, 1998 prepared by Aquatic Resources Center, College Grove, TN, for General Smelting and Refining, Inc., College Grove, TN, January 1999.

2. Exposure Investigation for College Grove Battery Chip Site, College Grove, Williamson County, Tennessee, November 3, 1999, prepared by Bonnie Bashor, Tennessee Health Department.

3. Agency Record of Activity for Harpeth River Site, conference call between Bob Safay (ATSDR), Channing Bennett (EPA), Charles Bourough (Tennessee Department of Health Waste Management Division), and Robert L. Williams (ATSDR), January 25, 2000.

Attachment 1

ATTACHMENT 1

RESULTS FROM WATER SAMPLES COLLECTED DURING STORM EVENTS AND NORMAL FLOWS, HARPETH RIVER, TENNESSEE, 1998

Parameters	Flow	Stormwater Site				Site 1				Site 2			
		Quarter (1998)				Quarter (1998)				Quarter (1998)			
		1	2	3	4	1	2	3	4	1	2	3	4
Antimony	storm	U	0.04	*[2]	0.17	U	U	*	U	U	U	*	0.0076
	normal	--	--	--	--	U	U	U	U	U	U	U	U
Arsenic	storm	U	U	*	0.014	U	U	*	U	U	U	*	U
	normal	--	--	--	--	U	U	U	U	U	U	U	U
Cadmium	storm	0.088	1.9	*	0.30	U	U	*	U	U	0.087	*	0.0012
	normal	--	--	--	--	U	U	U	U	U	0.0062	U	U
Lead	storm	0.098	2.1	*	0.42	0.0061	0.024	*	U	0.010	0.14	*	0.094
	normal	--	--	--	--	U	U	U	U	0.0077	0.0063	U	U
Zinc	storm	0.081	1.4	*	0.20	0.023	0.023	*	U	0.028	0.069	*	U
	normal	--	--	--	--	U	U	U	U	U	U	U	U
Temperature (°C)	storm	10.5	23.1	*	20.6	10.4	22.6	*	18.8	10.4	22.4	*	19.4
	normal	--	--	--	--	18.5	15.5	26.8	13.5	18.6	15.6	24.5	12.5
pH	storm	7.64	6.90	*	7.22	7.65	7.76	*	7.90	7.65	7.78	*	7.42
	normal	--	--	--	--	8.33	7.87	7.87	7.56	8.71	7.83	7.94	7.45
Dissolved oxygen (mg/L) [3]	storm	--	--	--	--	--	--	--	--	--	--	--	--
	normal	--	--	--	--	--	--	9.5	--	--	--	8.8	--
Conductivity (μSiemens/cm) [4]	storm	--	--	--	--	--	--	--	--	--	--	--	--
	normal	--	--	--	--	--	275	355	--	--	260	345	--

Taken from water & sediment survey of the Harpeth River near rm 110.3 College Grove, Tennessee, 1998.

Corrected Copy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

DEC 2 9 1998

4WD-RCRA

Dalton Mann
Executive Vice President
Chief Operations Manager
General Smelting & Refining Co.
8444 Horton Highway
College Grove, Tennessee 37046

SUBJ: Sampling Results
General Smelting & Refining Co.
EPA ID No: TND 00 404 8690

Dear Mr. Mann:

On July 6, 7, & 8, 1998, the United States Environmental Protection Agency (EPA) Science and Ecosystem Support Division (SESD), conducted a Case Development Investigation Evaluation at the subject facility in College Grove, Tennessee. Enclosed is SESD's soil, sediment, and surface water sampling results along the Harpeth River in the vicinity of General Smelting & Refining.

If you have any questions, please contact Kris Lippert, of my staff, at (404) 562-8605.

Sincerely yours,

Jeaneanne M. Gettle, Chief
North Enforcement & Compliance Section
RCRA Enforcement and Compliance Branch

Enclosure

cc: Charlie Burroughs, TDEC - Nashville Central Office (w/encl)
Dee Dee Kafthman, Aquatic Resources (w /encl)

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4, SCIENCE and ECOSYSTEM SUPPORT DIVISION
ATHENS, GEORGIA 30605-2720

4SES-EI

DEC 0 3 1998

MEMORANDUM

SUBJECT: Harpeth River/General Smelting & Refining, Inc.
Case Development Investigation Report
College Grove, Tennessee
SESD Project No. 98-0557

FROM: William R. Davis, Regional Expert
Hazardous Waste Section

THRU: Archie Lee, Chief
Hazardous Waste Section

TO: Jeaneanne Gettle, Chief
North Enforcement & Compliance Section
Enforcement & Compliance Branch

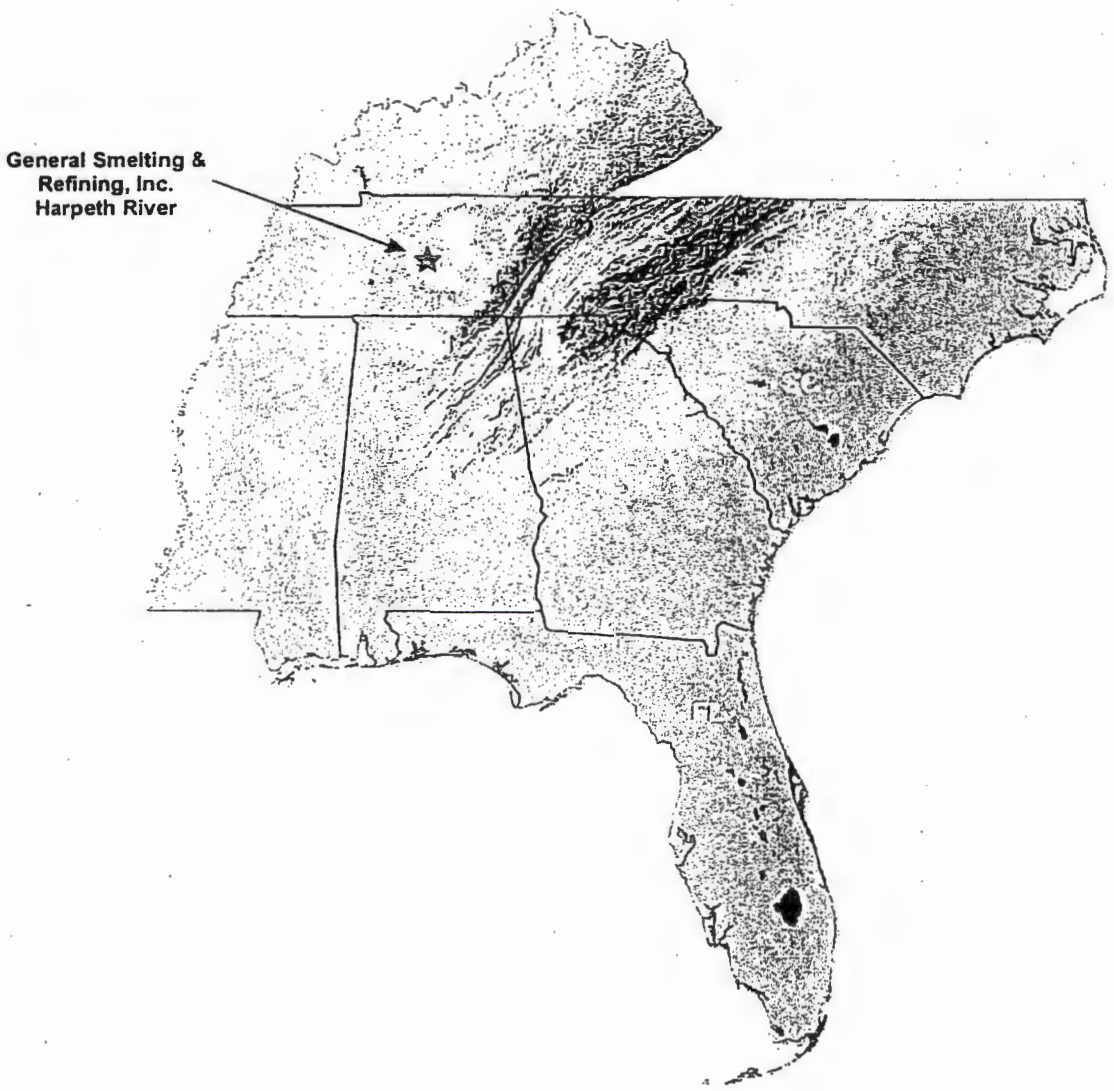
Attached is a copy of the report and ancillary materials relating to the CDIE investigation conducted during the week of July 6, 1998, at the subject location.

If you have any questions concerning this report or investigation support, please call Rod Davis, Project Leader, for this study at (706) 355-8607.

Attachments

cc: Kris Lippert/ECB

US EPA REGION 4
RCRA CASE DEVELOPMENT INVESTIGATION / EVALUATION
Harpeth River Study in the vicinity of
General Smelting & Refining, Inc.
College Grove, Tennessee



U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4, SCIENCE & ECOSYSTEM SUPPORT DIVISION
HAZARDOUS WASTE SECTION
980 COLLEGE STATION ROAD
ATHENS, GEORGIA 30605-2720

COVER.CDR

RCRA CASE DEVELOPMENT INVESTIGATION/EVALUATION
GENERAL SMELTING & REFINING, INC.
COLLEGE GROVE, TENNESSEE
TND004048690
SESD PROJECT NO. 98-0557

INTRODUCTION

William R. Davis and Art Masters of the U.S. Environmental Protection Agency (EPA), Science and Ecosystem Support Division (SESD), Hazardous Waste Section (HWS) and Kevin Simmons, Integrated Laboratory Services (ILS), contractor to EPA, Region 4 conducted a case development investigation (CDIE) in the Harpeth River basin in the vicinity of the General Smelting & Refining, Inc. (GSR), College Grove, Tennessee during July 7-8, 1998. This investigation was requested by the Enforcement and Compliance Branch (ECB), Waste Management Division (WMD), Region 4, Atlanta, Georgia.

A secondary lead smelting facility had occupied the same location since 1953. The company has changed ownership several times since its inception, but retained the same name. GSR is now a wholly owned subsidiary of Metalico, Inc. GSR has constructed a new plant on property adjacent to the original facility; during the investigation neither facility was in operation. The old facility is to be demolished and the property to be closed in accordance with their RCRA Permit.

DeDe Kafthman, Aquatic Resources Center, consultant for GSR was present during the investigation.

BACKGROUND

Facility and Locale

The GSR facility is located at 8444 Horton Highway, (US Highway 31-A), adjacent to and on the north side of the Harpeth River approximately 1.5 miles southwest from College Grove, Tennessee. With the exception of the College Grove Elementary School playground, the study area was located in the Harpeth River and adjacent banks in proximity to the GSR facility, and downstream for approximately one-mile. A general location map is shown in Figure 1. Sampling locations are shown in Figure 2.

The standard operating procedure for the secondary lead smelting operation prior to the passage of the Clean Water Act was to allow waste streams, which included lead contaminated spent battery acid, to flow untreated into the Harpeth River. Also, the indiscriminate disposal of battery casings in and around the facility introduced another significant source of environmental lead contamination. One steady state source of lead and heavy metals contamination originated from air emissions exiting the blast and reverberatory furnaces. Air pollution control equipment was later installed to reduced the lead emissions, but lead had already been deposited around the area.

Another source of past lead contamination was furnace slag. The slag was buried in a landfill or spread about as fill material. The various migration pathways mentioned above have allowed lead an opportunity to accumulate in the Harpeth River sediment and soil in the vicinity of the GRS plant.

SUMMARY

Lead concentrations were elevated throughout the study area. The farthest downstream sample G-4S, located approximately one mile downstream from GSR facility, contained 470 mg/kg of lead. The samples collected immediately adjacent to the plant and the Harpeth River contained lead at concentrations ranging from 1,600 mg/kg to 11,000 mg/kg. Two of the samples located adjacent to the plant, G-17S (6.4 mg/l) and G-20S (22 mg/l) had Toxicity Characteristic Leaching Procedure (TCLP) lead concentrations that exceeded the RCRA TC Rule regulatory level of 5.0 mg/l.

Two surface water samples collected from the Harpeth River downstream from the GSR plant contained 3.3 ug/l and 3.2 ug/l of lead; none was detected in the control sample..

DISCUSSION OF RESULTS

The approach to this investigation was to screen the Harpeth River sediment and river bank soil in the study area with an Niton X-ray Fluorescence instrument. This allowed for a rapid assessment of the study area and a scientific approach to selecting the locations for samples which would be analyzed in the laboratory. Twenty-two samples (19 soil/sediment and three surface water) were collected during the study. Tables 1-4 contain a summary of the total metals and TCLP data for the samples. Raw analytical data sheets are attached to this report as Appendix A. Seventeen photographs show the Harpeth River area under investigation and are attached to this report as Appendix B.

Alphabetic letters attached to the right of some of the reported analytical data values are footnotes which may indicate one of the following:

A - AVERAGE VALUE
J - ESTIMATED VALUE
N - PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
C - CONFIRMED BY GC/MS
L - ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
K - ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN
U - ANALYZED FOR BUT NOT DETECTED MINIMUM QUANTITATION NUMBER
N A- NOT ANALYZED

For reference to sample location, right bank and left bank are determined by looking upstream. The initial samples, G-1W and G-1S, water and sediment, respectively, were control samples collected at the College Grove Road bridge which crosses the Harpeth River approximately one mile upstream from the GSR location. Lead (56 mg/kg) concentrations in the sediment at this site were much lower than any of the comparative downstream stations.

Five stations (G-16S-G-20S) were located along the eastern side of the Harpeth River, directly beneath the bluff on which the GSR facility is located. The farthest upstream sample was G-16, a soil sample collected from the ditch which had drained the old GSR NPDES outfall. This sample contained 1,600 mg/kg lead, 160 mg/kg of cadmium and 12J mg/kg of antimony. The next sample G-17S, was also collected from soil on the bank. Lead and cadmium were detected at concentrations of 7,700 mg/kg for lead and 20 mg/kg for cadmium 92J mg/kg for antimony. The TCLP extract contained lead at a concentration of 6.4 mg/l, which exceeded the TC Rule regulatory level of 5.0 mg/l.

Sample G-18S was a sediment sample from the area adjacent to the river bank, and a few feet downstream from sample G-17S. The sample had lead detected at a concentration of 11,000 mg/kg, or approximately one percent lead. Other metals detected included arsenic (54 mg/kg), cadmium (23 mg/kg) and antimony (94J mg/kg). Sample GS-19S was collected from soil in an area just downstream from sample G-18S, on the river bank above the water line. Lead and cadmium concentrations were 4,100 mg/kg and 16 mg/kg, respectively.

The final sample collected from the vicinity of the plant was sample G-20S. This sample was taken from soil, approximately half-way up the bank from the water, and had lead and cadmium concentrations of 7,100 mg/kg and 3.1 mg/kg, respectively.

Sample G-15S was collected from beneath the US 31A highway bridge, immediately downstream from the GSR property. Lead was detected at a concentration of 4,000 mg/kg. The water is very shallow, but the flow is swift at this location. The sediment was minimal at this location, since it has a tendency to be swept on downstream..

Sample G-14S was collected from the river bank on the east side of the Harpeth River approximately 75 yards downstream from the highway bridge (and GSR) and just upstream from the dry wash area. Lead was detected at a concentration of 320 mg/kg.

Sample G-6S was a sediment sample collected near a weed bed, downstream from the dry wash, and was the farthest downstream sediment sample collected from within the Harpeth River. Lead was detected at a concentration of 750 mg/kg.

Sample G-4S was collected from the right river bank , downstream from sample G-6S, and came from an area where battery chips were present. Lead was detected at a concentration of 470 mg/kg. This station was the farthest downstream sample collected from the study. Another sample G-5S, was collected by augering into the bank approximately 5 feet behind sample G-4S, in an area that appeared to have been used as a dump for battery casings. There were numerous battery pieces located around the sample area, and from within the hole. The sample contained 140 mg/kg of lead.

Six samples were collected from within the back wash area, downstream from the GRS site and the bridge. The highest lead concentration for these locations was sample G-9S, collected from the bottom of the wash, near the confluence with the Harpeth River. Lead was detected in the sample at a concentration of 2,400 mg/kg. This area served as a sink for the back

wash and has concentrated the lead. Sample G-7S was taken from the right bank and G-8S from the left bank, near sample G-9S, and contained 960 mg/kg and 850 mg/kg of lead, respectively. Both of these samples from the sides of the wash, as well as sample G-9S, from the bed, indicate that water contaminated with high concentrations of lead had flowed through the wash during periods of elevated flow. Three other samples were collected from the entrance to the dry wash and had lead concentrations ranging from 490 mg/kg to 680 mg/kg.

Based upon the topography of the Harpeth River, downstream from the Highway 31A bridge, a natural conduit exists along the left bank (looking up stream), which during high water, would tend to collect any run off or discharge from the GMR facility, and cause that flow to discharge through the dry wash back into the Harpeth River at a point several hundred feet from the entrance to the dry wash. Since the lead contaminated plume would hug the same side of the bank as the dry branch is located, very little mixing would occur. Therefore, the more concentrated part of the water in the Harpeth River would flow through this dry wash. Since the dry wash is not under water at all times, it would not have been subjected to regular erosion and scouring as has the main channel of the Harpeth River. Therefore, migration of the lead contaminated soil from along it's banks through erosion would be less, and the lead concentrations would be higher.

Two surface water samples were collected downstream from the Highway 31A bridge. The first , G-2W was collected under the bridge and contained 3.3 ug/l of lead, and the second was collected at the farthest point downstream from the bridge, and contained 3.2 mg/l of lead. Lead was undetected in the control sample collected from the Harpeth River at a location approximately a mile upstream.

In addition to the 19 soil/sediment samples collected for laboratory analysis, approximately 80 XRF reading were taken throughout the study area. The XRF readings were used to screen the areas that were selected for samples which would be analyzed for metals. However, these values give a good indication of how extensive the lead migration was. There was a good correlation in most cases, between the in-situ readings from the XRF lead concentrations and the laboratory sample analysis. See Table 3 for a comparison of XRF and laboratory sample data..

CONCLUSIONS

Based upon the lead concentrations in the sediment and soil in the Harpeth River bed immediately adjacent to, and downstream from the GRS site, the Harpeth River has been contaminated with elevated concentrations of lead from the GRS facility. The river bank adjacent to the GRS facility is highly contaminated. In fact, the soil and sediment from two samples collected from the bank directly below the facility failed the TCLP test. Although this test was designed for determining the leachability of hazardous waste, the environmental samples were so saturated with lead that they exceeded the regulatory limits.

The extensive number of XRF determinations and the laboratory analytical results conclusively show that approximately one-mile of the Harpeth River, adjacent to and downstream from the GRS property is highly contaminated with lead.

Three XRF readings were taken at the playground of the College Grove Elementary school, which is located in the town of College Grove and south of the GRS facility. Lead was not detected at the school playground in the screening samples, and therefore no samples were collected for metals analysis.

METHODOLOGY

All samples were collected in accordance with the US-EPA, Region 4, Science and Ecosystem Support Division Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May, 1996, (EISOPQAM). Each sample was analyzed in the US-EPA Region 4, SESD Laboratory, in accordance with the Analytical Support Branch Operations and Quality Control Manual, December 1997.

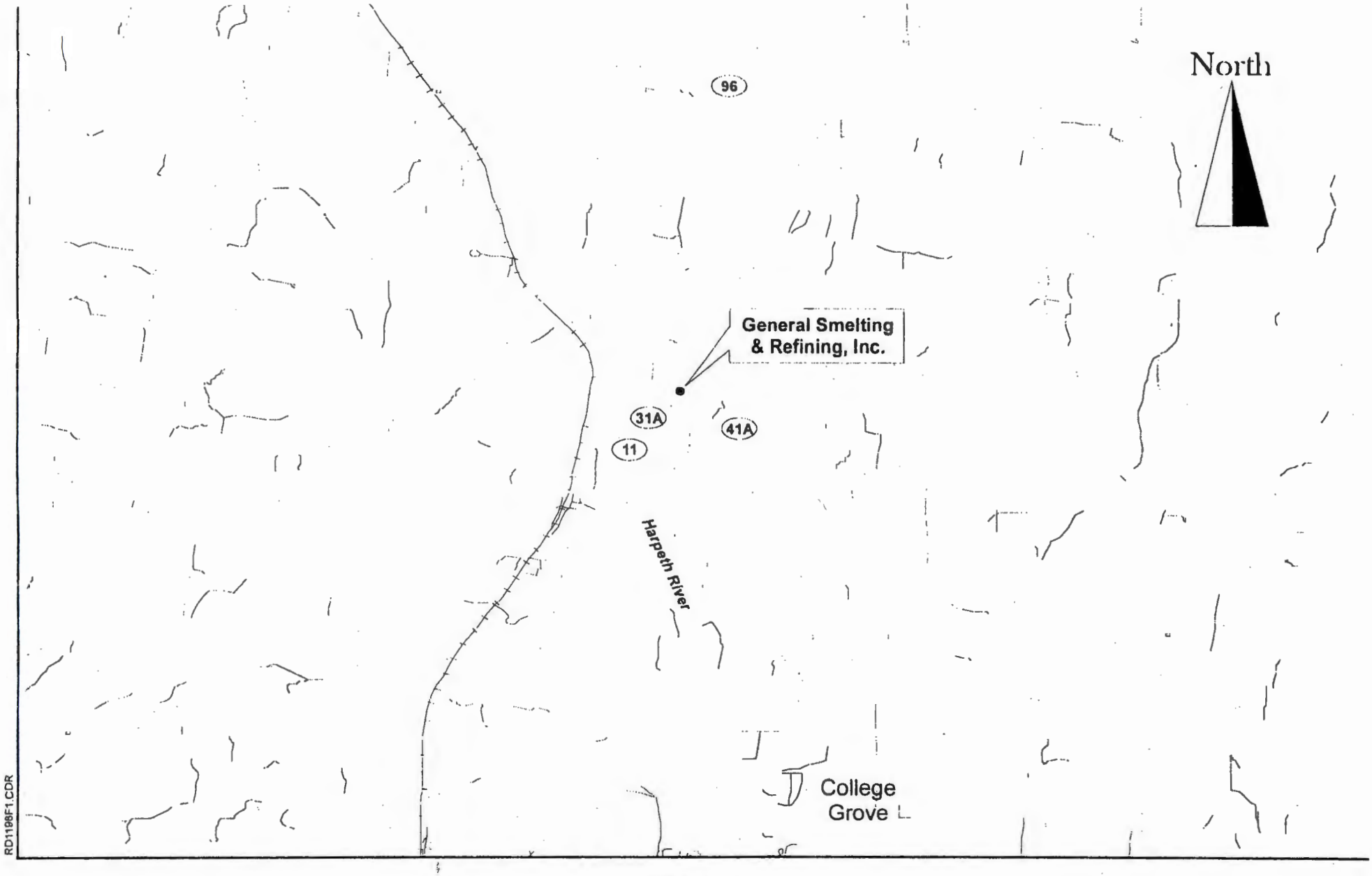
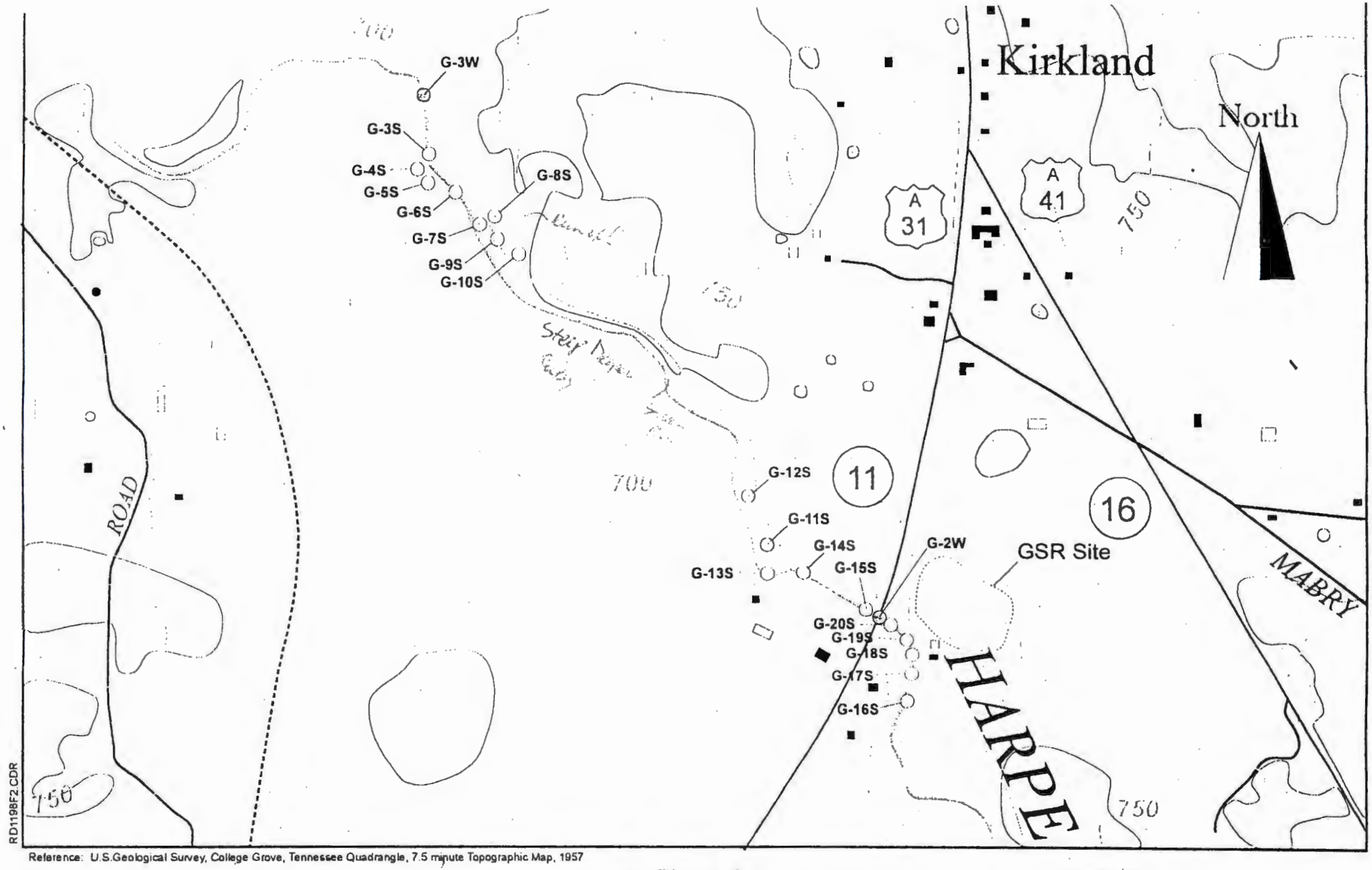


Figure 1

EPA

Area Location Map
Harpeth River / General Smelting & Refining, Inc.
College Grove, Tennessee



Reference: U.S.Geological Survey, College Grove, Tennessee Quadrangle, 7.5 minute Topographic Map, 1957

Figure 2

Legend:

- Water Samples
- Soil / Sediment Samples

EPA

Sample Locations
Harpeth River / General Smelting & Refining, Inc.
College Grove, Tennessee

Project Number: 98-0557
METALS SCAN

Table 1
Metals Scan (Sediment)
General Smelting & Refining Company
College Grove, Tennessee

		G1S 5928 7/7/98		G3S 5930 7/8/98		G4S 5932 7/8/98		G5S 5933 7/8/98		G6S 5934 7/8/98		G7S 5935 7/8/98		G8S 5936 7/8/98		G9S 5937 7/8/98	
	Units	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte
ALUMINUM	MG/KG	21000		20000		22000		21000		21000		24000		24000		26000	
ANTIMONY	MG/KG		UJ	5.1	J	4.7	J	1.1	J	37	J	6.6	J	1.8	J	3.5	J
ARSENIC	MG/KG	35		34		29		7.9		40		26		7.1		18	
BARIUM	MG/KG	440		470		210		180		470		370		140		200	
BERYLLIUM	MG/KG	4.6		4.5		4.1		1.8		4.6		3.4		--		2.9	
CADMIUM	MG/KG	--		--		--		--		--		--		--		--	
CALCIUM	MG/KG	18000		31000		17000		13000		40000		22000		7900		18000	
CHROMIUM	MG/KG	49		41		38		27		54		44		19		38	
COBALT	MG/KG		NA		NA		NA		NA		NA		NA	9.2		18	
COPPER	MG/KG	6.5		10		12		11		17		12		14		12	
IRON	MG/KG	130000		120000		470		38000		120000		83000		22000		6700	
LEAD	MG/KG	56		560		1700		140		750		960		850		2400	
MAGNESIUM	MG/KG	1600		1400		1700		2100		1800		1900		2100		2100	
MANGANESE	MG/KG	4500		3700		1700		1300		3300		3600		1300		1200	
NICKEL	MG/KG	17		20		19		14		20		18		13		18	
POTASSIUM	MG/KG	1700		2200		2300		2400		2000		2700		2300		2400	
STRONTIUM	MG/KG	150		190		100		80		180		110		44		100	
THALLIUM	MG/KG	--		--		--		--		--		--		--		--	
TIN	MG/KG	--		--		--		--		55				8.3		--	
TITANIUM	MG/KG	130		160		160		150		240		190		100		150	
TOTAL MERCURY	MG/KG	--		--		--		--		--		--		--		--	
VANADIUM	MG/KG	93		78		74		38		84		67		28		61	
YTTRIUM	MG/KG	42		61		49		28		58		48		20		40	
ZINC	MG/KG	52		60		75		64		130		60		52		65	

Footnote J - estimated concentration; -- - analyzed for but not detected, NA - not analyzed

Table 1 (continued)
Metals Scan (Sediment)
General Smelting & Refining Company
College Grove, Tennessee

Project Number: 98-0557
METALS SCAN

		G10S 5938 7/8/98		G11S 5939 7/8/98		G12S 5940 7/8/98		G13S 5941 7/8/98		G14S 5942 7/8/98		G15S 5943 7/8/98		G16S 5944 7/8/98		G17S 5945 7/8/98	
	Units	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte	Amount	Nte
ALUMINUM	MG/KG	21000		23000		21000		22000		19000		21000		24000		22000	
ANTIMONY	MG/KG	2.6	J	4	J	4.8	J	4.2	J	3.5	J	66	J	12	J	92	J
ARSENIC	MG/KG	5.8		10		15		40		23		61		18		120	
BARIUM	MG/KG	140		160		220		360		210		580		140		440	
BERYLLIUM	MG/KG	--		1.6		2.5		5.5		3.7		6.4		1.6		--	
CADMIUM	MG/KG	--		--		1.9		3.2		--		--		160		20	
CALCIUM	MG/KG	11000		16000		26000		33000		23000		48000		15000		19000	
CHROMIUM	MG/KG	22		29		34		59		40		50		33		44	
COBALT	MG/KG		NA		NA	18			NA		NA		NA		NA	15	
COPPER	MG/KG	11		14		15		11		10		25		52		250	
IRON	MG/KG	21000		32000		55000		150000		88000		210000		30000		58000	
LEAD	MG/KG	600		490		880		530		320		4000		1600		7700	
MAGNESIUM	MG/KG	2000		2100		1900		1700		1500		2600		2200		2300	
MANGANESE	MG/KG	1100		1400		2000		3600		2600		7800		1200		1400	
NICKEL	MG/KG	11		13		15		23		17		30		28		39	
POTASSIUM	MG/KG	2200		2800		2300		1900		2000		--		3000		2500	
STRONTIUM	MG/KG	52		74		110		180		140		160		68		85	
THALLIUM	MG/KG	--		--		--		--		--		--		8.3		--	
TIN	MG/KG	--		--		10		--		--		70		--		190	
TITANIUM	MG/KG	150		140		210		170		150		150		200		250	
TOTAL MERCURY	MG/KG	--		--		--		--		--		--		--		--	
VANADIUM	MG/KG	26		36		48		110		70		140		37		36	
YTTRIUM	MG/KG	21		29		46		57		46		53		28		28	
ZINC	MG/KG	48		50		58		69		51		98		250		240	

Footnote J - estimated concentration; -- - analyzed for but not detected, NA - not analyzed

Table 1 (continued)
Metals Scan (Sediment)
General Smelting & Refining Company
College Grove, Tennessee

Project Number: 98-0557
METALS SCAN

		G18S 5948 7/8/98		G19S 5947 7/8/98		G20S 5948 7/8/98	
	Units	Amount	Nte	Amount	Nte	Amount	Nte
ALUMINUM	MG/KG	31000		22000		20000	
ANTIMONY	MG/KG	94	J	22	J	31	J
ARSENIC	MG/KG	54		22		17	
BARIUM	MG/KG	140		140		160	
BERYLLIUM	MG/KG	2.4		--		--	
CADMIUM	MG/KG	23		16		3.1	
CALCIUM	MG/KG	19000		11000		12000	
CHROMIUM	MG/KG	21		22		28	
COBALT	MG/KG	16			NA		NA
COPPER	MG/KG	67		56		49	
IRON	MG/KG	34000		24000		26000	
LEAD	MG/KG	11000		4100		7100	
MAGNESIUM	MG/KG	2000		2300		1900	
MANGANESE	MG/KG	910		1100		1100	
NICKEL	MG/KG	20		16		13	
POTASSIUM	MG/KG	1900		3300		2400	
STRONTIUM	MG/KG	70		52		72	
THALLIUM	MG/KG	--		--		--	
TIN	MG/KG	72		17		13	
TITANIUM	MG/KG	140		120		160	
TOTAL MERCURY	MG/KG	0.09		--		0.052	
VANADIUM	MG/KG	30		28		30	
YTTRIUM	MG/KG	61		23		22	
ZINC	MG/KG	160		83		64	

Footnote J - estimated concentration; -- - analyzed for but not detected, NA - not analyzed

Table 2
TCLP Metals Scan (Sediment)
General Smelting & Refining Company
College Grove, Tennessee

Project Number: 98-0557
METALS TCLP SCAN

		G6S 5934 7/8/98		G7S 5935 7/8/98		G8S 5936 7/8/98		G9S 5937 7/8/98		G10S 5938 7/8/98		G12S 5940 7/8/98		G15S 5943 7/8/98		G16S 5944 7/8/98	
	Units	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**
ANTIMONY	MG/L	--		--		--		--		--		--		--		0.29	
BARIUM	MG/L	--		--		--		--		--		--		0.56		0.47	
CADMIUM	MG/L	--		--		--		--		--		--		--		1.9	
LEAD	MG/L	--		0.2		--		1		--		--		1.6		1.4	
NICKEL	MG/L	--		--		--		--		--		--		--		0.1	

		G17S 5945 7/8/98		G18S 5946 7/8/98		G19S 5947 7/8/98		G20S 5948 7/8/98	
	Units	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**	**Amount**	**Nte**
ANTIMONY	MG/L	0.2			NA	--		0.29	
BARIUM	MG/L	0.75			NA	0.45		0.6	
CADMIUM	MG/L	0.17			NA	0.15		0.043	
LEAD	MG/L	6.4			NA	3.6		22	
NICKEL	MG/L	--			NA	--		--	

Footnote J - estimated concentration; -- - analyzed for but not detected, NA - not analyzed

Table 3
Metals Scan (Water)
General Smelting & Refining Company
College Grove, Tennessee

Project Number: 98-0557
METALS SCAN

	Units	G1W 5927 7/7/98 Amount	Nte	G2W 5929 7/8/98 Amount	Nte	G3W 5931 7/8/98 Amount	Nte	QA001PB 5949 7/8/98 Amount	Nte
ALUMINUM	UG/L	240		260		300		--	
ANTIMONY	UG/L	--		0.39		0.44		--	
BARIUM	UG/L	32		30		29		--	
CADMIUM	UG/L	--		--		0.21		--	
CALCIUM	MG/L	67		62		61		--	
COPPER	UG/L	0.69		0.66		0.64		--	
IRON	MG/L	0.12		0.19		0.18		--	
LEAD	UG/L	--		3.3		3.2		2.1	
MAGNESIUM	MG/L	5.2		6.2		5.7		--	
MANGANESE	UG/L	47		67		45		--	
POTASSIUM	MG/L	2.4		2.8		2.7		--	
SODIUM	MG/L	5.1		4.7		4.6		--	
STRONTIUM	UG/L	120		110		110		--	
ZINC	UG/L	4.4		5.3		5.2		3.9	

Footnote J - estimated concentration; -- - analyzed for but not detected

Table 4
XRF and ICAP Lead Value Comparisons
Concentrations in Parts Per Million
General Smelting and Refining, Inc.
College Grove, TN

XRF #	Date	Flag #	Field Sample #	XRF	ICAP
15	07/07/98	1	G-12S	330	680
16	07/07/98	2		460	490
17	07/07/98	N/A		N/D	NA
18	07/07/98	3		110	NA
19	07/07/98	4		170	NA
20	07/07/98	N/A		N/D	NA
21	07/07/98	N/A		N/D	NA
22	07/07/98	6	G-10S	580	600
28	07/07/98	7	G-9S	660	NA
29	07/07/98	8		330	2400
30	07/07/98	9		310	NA
31	07/07/98	10	G-8S	350	850
32	07/07/98	11	G-7S	410	960
33	07/07/98	12		N/D	NA
34	07/07/98	13		N/D	NA
35	07/07/98	14		78	NA
36	07/07/98	15		91	NA
37	07/07/98	16	G-6S	380	750
38	07/07/98	17		N/D	NA
39	07/07/98	18		140	NA
40	07/07/98	19		180	NA
47	07/07/98	20		N/D	NA
48	07/07/98	21		180	NA
49	07/07/98	22		90	NA
50	07/07/98	23		N/D	NA
51	07/07/98	24	G-4S	400	470
52	07/07/98	25	G-5S	120	116
53	07/07/98	26		N/D	NA
54	07/07/98	Battery Casing		570	NA
55	07/07/98	27		180	NA
56	07/07/98	28	G-3S	1000	560
57	07/07/98	29		110	NA
63	07/07/98	30		510	NA
64	07/07/98	31		270	NA
65	07/07/98	N/A		N/D	NA
66	07/07/98	32		130	NA
67	07/07/98	33		N/D	NA
71	07/07/98	34		N/D	NA
72	07/07/98	35	G-13S	250	530
73	07/07/98	36		120	NA

Table 4
XRF and ICAP Lead Value Comparisons
Concentrations in Parts Per Million
General Smelting and Refining, Inc.
College Grove, TN

XRF #	Date	Flag #	Field Sample #	XRF	ICAP
74	07/07/98	37		170	NA
75	07/07/98	38		N/D	NA
76	07/07/98	39		N/D	NA
77	07/07/98	40		100	NA
78	07/07/98	41	G-14S	310	320
79	07/07/98	42		210	NA
80	07/07/98	43		200	NA
81	07/07/98	44		240	NA
82	07/07/98	45		120	NA
83	07/07/98	46		N/D	NA
84	07/07/98	47		190	NA
85	07/07/98	48		620	NA
86	07/07/98	49	G-15S	4000	2000
100	07/08/98	50		120	NA
101	07/08/98	51		N/D	NA
102	07/08/98	52		N/D	NA
103	07/08/98	53		N/D	NA
104	07/08/98	54	G-20S	7100	1400
105	07/08/98	55	G-19S	4100	960
106	07/08/98	56		100	NA
107	07/08/98	57		200	NA
108	07/08/98	58		1300	NA
114	07/08/98	59	G-18S	5300	11000
115	07/08/98	60		1400	NA
116	07/08/98	61		N/D	NA
117	07/08/98	62		8600	NA
123	07/08/98	63		360	NA
124	07/08/98	64		N/D	NA
125	07/08/98	65		N/D	NA
126	07/08/98	66	G-17S	5000	7700
127	07/08/98	67		220	NA
128	07/08/98	68		66	NA
129	07/08/98	69		150	NA
130	07/08/98	70		180	NA
131	07/08/98	71		N/D	NA
132	07/08/98	72	G-16S	1200	1600
133	07/08/98	73		N/D	NA
139	07/08/98	College Grove Elem		N/D	NA
140	07/08/98	College Grove Elem		N/D	NA
141	07/08/98	College Grove Elem		N/D	NA

ND - non detected, NA - not analyzed

APPENDIX A

PHOTOGRAPHS

Date: 7/7/98 Photographer: W. R. Davis

XRF Instrument being used in-situ.

Date: 7/7/98 Photographer: W. R. Davis

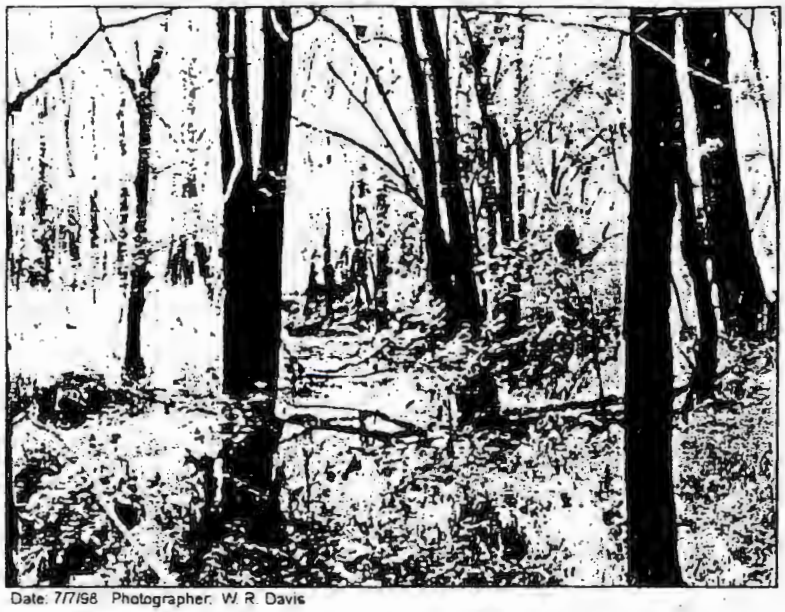
Harpeth River, downstream from GSR and 31A bridge excavation.

Date: 7/7/98 Photographer: W. R. Davis

Harpeth River, looking toward bridge and GSR;
river just downstream from site.

Date: 7/7/98 Photographer: W. R. Davis

Dry wash that carries water from Harpeth River
during high water flow, left side of flow (GSR side).



Date: 7/7/98 Photographer: W. R. Davis

Dry wash that carries water from Harpeth River, this shot is looking upstream from near the lower point of confluence with the river. Red flags indicate location of XFR stations.

Date: 7/7/98 Photographer: W. R. Davis

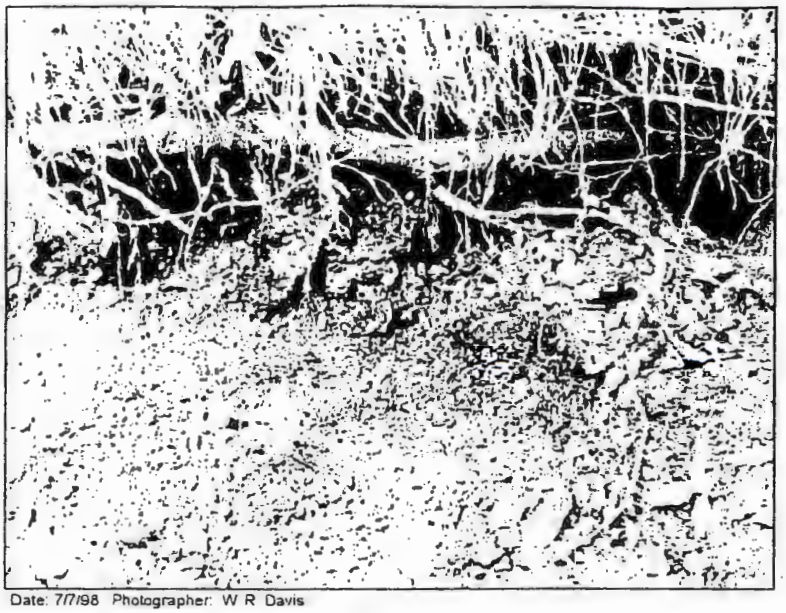
Looking upstream in dry wash. This shot is from the area where samples G-7S, G-8S and G-9S were collected.

Date: 7/7/98 Photographer: W. R. Davis

Looking upstream in dry wash. This shot is from the point of confluence with the Harpeth River. Red flags show the XRF locations.

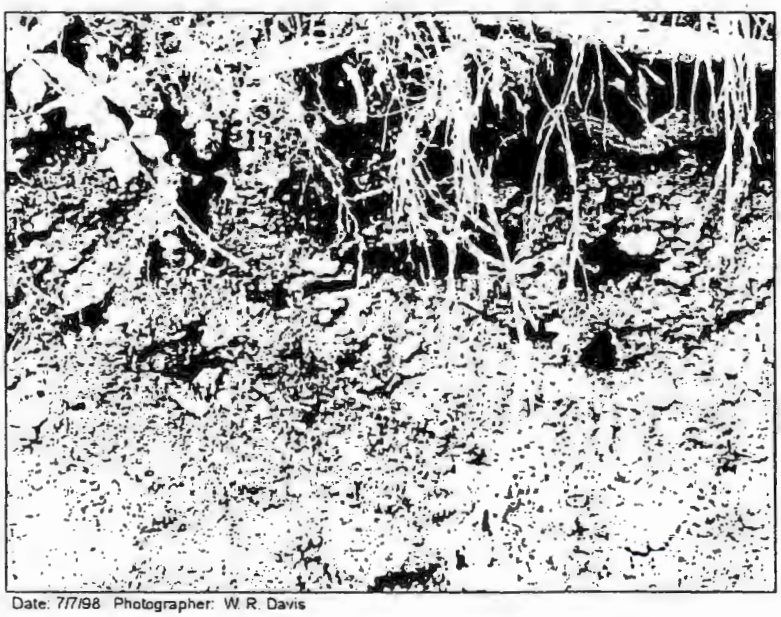
Date: 7/7/98 Photographer: W. R. Davis

Looking upstream from weed-bed and gravel-bar; dry wash is to the left, main stream of the Harpeth is to the right and splits around the weed bed.



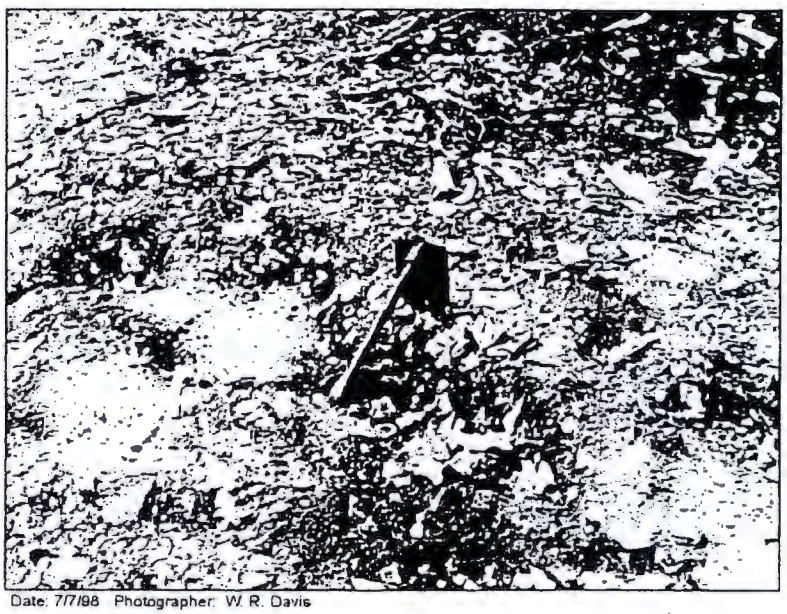
Date: 7/7/98 Photographer: W R Davis

Area along the right bank, note battery chips in soil.
About 200 yds. downstream from dry wash.



Date: 7/7/98 Photographer: W R Davis

Area along the right bank, note battery chips in soil.
About 200 yds. downstream from dry wash.



Date: 7/7/98 Photographer: W. R. Davis

Area where battery casings had been removed by GSR.
Soil was stained.

Date: 7/7/98 Photographer: W. R. Davis

Harpeth River, downstream from dry wash and area where
battery casings had been found in the bank.

Date: 7/7/98 Photographer: W.R. Davis

Harpeth River, farthest downstream point sampled during investigation.

Date: 7/7/98 Photographer: W. R. Davis

Harpeth River, XRF analysis of lead in soil; location is Harpeth River bank; note battery casings on ground and in the black bag.

Date: 7/7/98 Photographer: W. R. Davis

Harpeth River, main course taken from a back-shoot on the right bank. The dry wash is located over the bank to the right of this picture.

Date: 7/7/98 Photographer: W. R. Davis

Harpeth River, main course taken from upstream from the dry wash confluence enters. Note weed-bed at farthest point of picture.

Date: 7/7/98 Photographer: W.R. Davis

Harpeth River, main course taken from upstream where the dry wash confluence enters. Note weed-bed at farthest point of picture.

EPA

PhotoLog
General Smelting & Refining, Inc.
College Grove, Tennessee

RCRA CASE DEVELOPMENT INVESTIGATION/EVALUATION
GENERAL SMELTING & REFINING, INC.
COLLEGE GROVE, TENNESSEE
TND004048690
SESD PROJECT NO. 98-0557

INTRODUCTION

William R. Davis and Art Masters of the U.S. Environmental Protection Agency (EPA), Science and Ecosystem Support Division (SESD), Hazardous Waste Section (HWS) and Kevin Simmons, Integrated Laboratory Services (ILS), contractor to EPA, Region 4 conducted a case development investigation (CDIE) in the Harpeth River basin in the vicinity of the General Smelting & Refining, Inc. (GSR), College Grove, Tennessee during July 7-8, 1998. This investigation was requested by the Enforcement and Compliance Branch (ECB), Waste Management Division (WMD), Region 4, Atlanta, Georgia.

A secondary lead smelting facility had occupied the same location since 1953. The company has changed ownership several times since its inception, but retained the same name. GSR is now a wholly owned subsidiary of Metalico, Inc. GSR has constructed a new plant on property adjacent to the original facility; during the investigation neither facility was in operation. The old facility is to be demolished and the property to be closed in accordance with their RCRA Permit.

DeDe Kafthman, Aquatic Resources Center, consultant for GSR was present during the investigation.

BACKGROUND

Facility and Locale

The GSR facility is located at 8444 Horton Highway, (US Highway 31-A), adjacent to and on the north side of the Harpeth River approximately 1.5 miles southwest from College Grove, Tennessee. With the exception of the College Grove Elementary School playground, the study area was located in the Harpeth River and adjacent banks in proximity to the GSR facility, and downstream for approximately one-mile. A general location map is shown in Figure 1. Sampling locations are shown in Figure 2.

The standard operating procedure for the secondary lead smelting operation prior to the passage of the Clean Water Act was to allow waste streams, which included lead contaminated spent battery acid, to flow untreated into the Harpeth River. Also, the indiscriminate disposal of battery casings in and around the facility introduced another significant source of environmental lead contamination. One steady state source of lead and heavy metals contamination originated from air emissions exiting the blast and reverberatory furnaces. Air pollution control equipment was later installed to reduced the lead emissions, but lead had already been deposited around the area.

Another source of past lead contamination was furnace slag. The slag was buried in a landfill or spread about as fill material. The various migration pathways mentioned above have allowed lead an opportunity to accumulate in the Harpeth River sediment and soil in the vicinity of the GRS plant.

SUMMARY

Lead concentrations were elevated throughout the study area. The farthest downstream sample G-4S, located approximately one mile downstream from GSR facility, contained 470 mg/kg of lead. The samples collected immediately adjacent to the plant and the Harpeth River contained lead at concentrations ranging from 1,600 mg/kg to 11,000 mg/kg. Two of the samples located adjacent to the plant, G-17S (6.4 mg/l) and G-20S (22 mg/l) had Toxicity Characteristic Leaching Procedure (TCLP) lead concentrations that exceeded the RCRA TC Rule regulatory level of 5.0 mg/l.

Two surface water samples collected from the Harpeth River downstream from the GSR plant contained 3.3 ug/l and 3.2 ug/l of lead; none was detected in the control sample..

DISCUSSION OF RESULTS

The approach to this investigation was to screen the Harpeth River sediment and river bank soil in the study area with an Niton X-ray Fluorescence instrument. This allowed for a rapid assessment of the study area and a scientific approach to selecting the locations for samples which would be analyzed in the laboratory. Twenty-two samples (19 soil/sediment and three surface water) were collected during the study. Tables 1-4 contain a summary of the total metals and TCLP data for the samples. Raw analytical data sheets are attached to this report as Appendix A. Seventeen photographs show the Harpeth River area under investigation and are attached to this report as Appendix B.

Alphabetic letters attached to the right of some of the reported analytical data values are footnotes which may indicate one of the following:

A - AVERAGE VALUE
J - ESTIMATED VALUE
N - PRESUMPTIVE EVIDENCE OF PRESENCE OF MATERIAL
C - CONFIRMED BY GC/MS
L - ACTUAL VALUE IS KNOWN TO BE GREATER THAN VALUE GIVEN
K - ACTUAL VALUE IS KNOWN TO BE LESS THAN VALUE GIVEN
U - ANALYZED FOR BUT NOT DETECTED MINIMUM QUANTITATION NUMBER
N A- NOT ANALYZED

For reference to sample location, right bank and left bank are determined by looking upstream. The initial samples, G-1W and G-1S, water and sediment, respectively, were control samples collected at the College Grove Road bridge which crosses the Harpeth River approximately one mile upstream from the GSR location. Lead (56 mg/kg) concentrations in the sediment at this site were much lower than any of the comparative downstream stations.

Five stations (G-16S-G-20S) were located along the eastern side of the Harpeth River, directly beneath the bluff on which the GSR facility is located. The farthest upstream sample was G-16, a soil sample collected from the ditch which had drained the old GSR NPDES outfall. This sample contained 1,600 mg/kg lead, 160 mg/kg of cadmium and 12J mg/kg of antimony. The next sample G-17S, was also collected from soil on the bank. Lead and cadmium were detected at concentrations of 7,700 mg/kg for lead and 20 mg/kg for cadmium 92J mg/kg for antimony. The TCLP extract contained lead at a concentration of 6.4 mg/l, which exceeded the TC Rule regulatory level of 5.0 mg/l.

Sample G-18S was a sediment sample from the area adjacent to the river bank, and a few feet downstream from sample G-17S. The sample had lead detected at a concentration of 11,000 mg/kg, or approximately one percent lead. Other metals detected included arsenic (54 mg/kg), cadmium (23 mg/kg) and antimony (94J mg/kg). Sample GS-19S was collected from soil in an area just downstream from sample G-18S, on the river bank above the water line. Lead and cadmium concentrations were 4,100 mg/kg and 16 mg/kg, respectively.

The final sample collected from the vicinity of the plant was sample G-20S. This sample was taken from soil, approximately half-way up the bank from the water, and had lead and cadmium concentrations of 7,100 mg/kg and 3.1 mg/kg, respectively.

Sample G-15S was collected from beneath the US 31A highway bridge, immediately downstream from the GSR property. Lead was detected at a concentration of 4,000 mg/kg. The water is very shallow, but the flow is swift at this location. The sediment was minimal at this location, since it has a tendency to be swept on downstream..

Sample G-14S was collected from the river bank on the east side of the Harpeth River approximately 75 yards downstream from the highway bridge (and GSR) and just upstream from the dry wash area. Lead was detected at a concentration of 320 mg/kg.

Sample G-6S was a sediment sample collected near a weed bed, downstream from the dry wash, and was the farthest downstream sediment sample collected from within the Harpeth River. Lead was detected at a concentration of 750 mg/kg.

Sample G-4S was collected from the right river bank , downstream from sample G-6S, and came from an area where battery chips were present. Lead was detected at a concentration of 470 mg/kg. This station was the farthest downstream sample collected from the study. Another sample G-5S, was collected by augering into the bank approximately 5 feet behind sample G-4S, in an area that appeared to have been used as a dump for battery casings. There were numerous battery pieces located around the sample area, and from within the hole. The sample contained 140 mg/kg of lead.

Six samples were collected from within the back wash area, downstream from the GRS site and the bridge. The highest lead concentration for these locations was sample G-9S, collected from the bottom of the wash, near the confluence with the Harpeth River. Lead was detected in the sample at a concentration of 2,400 mg/kg. This area served as a sink for the back

wash and has concentrated the lead. Sample G-7S was taken from the right bank and G-8S from the left bank, near sample G-9S, and contained 960 mg/kg and 850 mg/kg of lead, respectively. Both of these samples from the sides of the wash, as well as sample G-9S, from the bed, indicate that water contaminated with high concentrations of lead had flowed through the wash during periods of elevated flow. Three other samples were collected from the entrance to the dry wash and had lead concentrations ranging from 490 mg/kg to 680 mg/kg.

Based upon the topography of the Harpeth River, downstream from the Highway 31A bridge, a natural conduit exists along the left bank (looking up stream), which during high water, would tend to collect any run off or discharge from the GMR facility, and cause that flow to discharge through the dry wash back into the Harpeth River at a point several hundred feet from the entrance to the dry wash. Since the lead contaminated plume would hug the same side of the bank as the dry branch is located, very little mixing would occur. Therefore, the more concentrated part of the water in the Harpeth River would flow through this dry wash. Since the dry wash is not under water at all times, it would not have been subjected to regular erosion and scouring as has the main channel of the Harpeth River. Therefore, migration of the lead contaminated soil from along it's banks through erosion would be less, and the lead concentrations would be higher.

Two surface water samples were collected downstream from the Highway 31A bridge. The first , G-2W was collected under the bridge and contained 3.3 ug/l of lead, and the second was collected at the farthest point downstream from the bridge, and contained 3.2 mg/l of lead. Lead was undetected in the control sample collected from the Harpeth River at a location approximately a mile upstream.

In addition to the 19 soil/sediment samples collected for laboratory analysis, approximately 80 XRF reading were taken throughout the study area. The XRF readings were used to screen the areas that were selected for samples which would be analyzed for metals. However, these values give a good indication of how extensive the lead migration was. There was a good correlation in most cases, between the in-situ readings from the XRF lead concentrations and the laboratory sample analysis. See Table 3 for a comparison of XRF and laboratory sample data..

CONCLUSIONS

Based upon the lead concentrations in the sediment and soil in the Harpeth River bed immediately adjacent to, and downstream from the GRS site, the Harpeth River has been contaminated with elevated concentrations of lead from the GRS facility. The river bank adjacent to the GRS facility is highly contaminated. In fact, the soil and sediment from two samples collected from the bank directly below the facility failed the TCLP test. Although this test was designed for determining the leachability of hazardous waste, the environmental samples were so saturated with lead that they exceeded the regulatory limits.

The extensive number of XRF determinations and the laboratory analytical results conclusively show that approximately one-mile of the Harpeth River, adjacent to and downstream from the GRS property is highly contaminated with lead.

Three XRF readings were taken at the playground of the College Grove Elementary school, which is located in the town of College Grove and south of the GRS facility. Lead was not detected at the school playground in the screening samples, and therefore no samples were collected for metals analysis.

METHODOLOGY

All samples were collected in accordance with the US-EPA, Region 4, Science and Ecosystem Support Division Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May, 1996, (EISOPQAM). Each sample was analyzed in the US-EPA Region 4, SESD Laboratory, in accordance with the Analytical Support Branch Operations and Quality Control Manual, December 1997.

APPENDIX B
ANALYTICAL DATA

Sample 5928 FY 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G1S /
Media: SEDIMENT

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/07/98 08:25
Ending:

RESULTS	UNITS	ANALYTE
7.0U	MG/KG	SILVER
35	MG/KG	ARSENIC
NA	MG/KG	BORON
440	MG/KG	BARIUM
4.6	MG/KG	BERYLLIUM
3.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
49	MG/KG	CHROMIUM
6.5	MG/KG	COPPER
7.0U	MG/KG	MOLYBDENUM
17	MG/KG	NICKEL
56	MG/KG	LEAD
1.0UJ	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
18U	MG/KG	TIN
150	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
130	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
93	MG/KG	VANADIUM
42	MG/KG	YTTRIUM
52	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
4500	MG/KG	MANGANESE
18000	MG/KG	CALCIUM
1600	MG/KG	MAGNESIUM
130000	MG/KG	IRON
NA	MG/KG	SODIUM
1700	MG/KG	POTASSIUM
30	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 08:50
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G3S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
7.0U	MG/KG	SILVER
34	MG/KG	ARSENIC
NA	MG/KG	BORON
470	MG/KG	BARIUM
4.5	MG/KG	BERYLLIUM
3.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
41	MG/KG	CHROMIUM
10	MG/KG	COPPER
7.0U	MG/KG	MOLYBDENUM
20	MG/KG	NICKEL
560	MG/KG	LEAD
5.1J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
18U	MG/KG	TIN
190	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
160	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
78	MG/KG	VANADIUM
61	MG/KG	YTTRIUM
60	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
20000	MG/KG	ALUMINUM
3700	MG/KG	MANGANESE
31000	MG/KG	CALCIUM
1400	MG/KG	MAGNESIUM
120000	MG/KG	IRON
NA	MG/KG	SODIUM
2200	MG/KG	POTASSIUM
22	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Project: 98-0557

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 09:00
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G4S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
7.0U	MG/KG	SILVER
29	MG/KG	ARSENIC
NA	MG/KG	BORON
210	MG/KG	BARIUM
4.1	MG/KG	BERYLLIUM
3.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
38	MG/KG	CHROMIUM
12	MG/KG	COPPER
7.0U	MG/KG	MOLYBDENUM
19	MG/KG	NICKEL
470	MG/KG	LEAD
4.7J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
18U	MG/KG	TIN
100	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
160	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
74	MG/KG	VANADIUM
49	MG/KG	YTTRIUM
75	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
22000	MG/KG	ALUMINUM
1700	MG/KG	MANGANESE
17000	MG/KG	CALCIUM
1700	MG/KG	MAGNESIUM
120000	MG/KG	IRON
NA	MG/KG	SODIUM
2300	MG/KG	POTASSIUM
26	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample [illegible] Project: 98-0557

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 09:15
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G5S /
Media: SUBSURFACE SOIL (> 12")

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
7.9	MG/KG	ARSENIC
NA	MG/KG	BORON
180	MG/KG	BARIUM
1.8	MG/KG	BERYLLIUM
1.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
27	MG/KG	CHROMIUM
11	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
14	MG/KG	NICKEL
140	MG/KG	LEAD
1.1J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
7.5U	MG/KG	TIN
80	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
150	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
38	MG/KG	VANADIUM
28	MG/KG	YTTRIUM
64	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
1300	MG/KG	MANGANESE
13000	MG/KG	CALCIUM
2100	MG/KG	MAGNESIUM
38000	MG/KG	IRON
NA	MG/KG	SODIUM
2400	MG/KG	POTASSIUM
36	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced By: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 09:25
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G6S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
7.0U	MG/KG	SILVER
40	MG/KG	ARSENIC
NA	MG/KG	BORON
470	MG/KG	BARIUM
4.6	MG/KG	BERYLLIUM
3.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
54	MG/KG	CHROMIUM
17	MG/KG	COPPER
7.0U	MG/KG	MOLYBDENUM
20	MG/KG	NICKEL
750	MG/KG	LEAD
37J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
55	MG/KG	TIN
180	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
240	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
84	MG/KG	VANADIUM
58	MG/KG	YTTRIUM
130	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
3300	MG/KG	MANGANESE
40000	MG/KG	CALCIUM
1800	MG/KG	MAGNESIUM
120000	MG/KG	IRON
NA	MG/KG	SODIUM
2000	MG/KG	POTASSIUM
17	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Project: 98-0337

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:10
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G7S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
5.0U	MG/KG	SILVER
26	MG/KG	ARSENIC
NA	MG/KG	BORON
370	MG/KG	BARIUM
3.4	MG/KG	BERYLLIUM
2.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
44	MG/KG	CHROMIUM
12	MG/KG	COPPER
5.0U	MG/KG	MOLYBDENUM
18	MG/KG	NICKEL
960	MG/KG	LEAD
6.6J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
12U	MG/KG	TIN
110	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
190	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
67	MG/KG	VANADIUM
48	MG/KG	YTTRIUM
60	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
24000	MG/KG	ALUMINUM
3600	MG/KG	MANGANESE
22000	MG/KG	CALCIUM
1900	MG/KG	MAGNESIUM
83000	MG/KG	IRON
NA	MG/KG	SODIUM
2700	MG/KG	POTASSIUM
20	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Project: 98-0337

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:20
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G8S /
Media: SUBSURFACE SOIL (> 12")

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
7.1	MG/KG	ARSENIC
NA	MG/KG	BORON
140	MG/KG	BARIUM
1.5U	MG/KG	BERYLLIUM
1.5U	MG/KG	CADMIUM
9.2	MG/KG	COBALT
19	MG/KG	CHROMIUM
14	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
13	MG/KG	NICKEL
850	MG/KG	LEAD
1.8J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
8.3	MG/KG	TIN
44	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
100	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
28	MG/KG	VANADIUM
20	MG/KG	YTTRIUM
52	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
24000	MG/KG	ALUMINUM
1300	MG/KG	MANGANESE
7900	MG/KG	CALCIUM
2100	MG/KG	MAGNESIUM
22000	MG/KG	IRON
NA	MG/KG	SODIUM
2300	MG/KG	POTASSIUM
17	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 5937 FY 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G9S /
Media: SEDIMENT

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:30
Ending:

RESULTS	UNITS	ANALYTE
4.0U	MG/KG	SILVER
18	MG/KG	ARSENIC
NA	MG/KG	BORON
200	MG/KG	BARIUM
2.9	MG/KG	BERYLLIUM
2.0U	MG/KG	CADMIUM
18	MG/KG	COBALT
38	MG/KG	CHROMIUM
12	MG/KG	COPPER
4.0U	MG/KG	MOLYBDENUM
18	MG/KG	NICKEL
2400	MG/KG	LEAD
3.5J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
10U	MG/KG	TIN
100	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
150	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
61	MG/KG	VANADIUM
40	MG/KG	YTTRIUM
65	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
26000	MG/KG	ALUMINUM
1200	MG/KG	MANGANESE
18000	MG/KG	CALCIUM
2100	MG/KG	MAGNESIUM
6700	MG/KG	IRON
NA	MG/KG	SODIUM
2400	MG/KG	POTASSIUM
35	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:45
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G10S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
5.8	MG/KG	ARSENIC
NA	MG/KG	BORON
140	MG/KG	BARIUM
1.5U	MG/KG	BERYLLIUM
1.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
22	MG/KG	CHROMIUM
11	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
11	MG/KG	NICKEL
600	MG/KG	LEAD
2.6J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
7.5U	MG/KG	TIN
52	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
150	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
26	MG/KG	VANADIUM
21	MG/KG	YTTRIUM
46	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
1100	MG/KG	MANGANESE
11000	MG/KG	CALCIUM
2000	MG/KG	MAGNESIUM
21000	MG/KG	IRON
NA	MG/KG	SODIUM
2200	MG/KG	POTASSIUM
20	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 3939 FY 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G11S /
Media: SURFACE SOIL (0" - 12")

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 11:00
Ending:

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
10	MG/KG	ARSENIC
NA	MG/KG	BORON
160	MG/KG	BARIUM
1.6	MG/KG	BERYLLIUM
1.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
29	MG/KG	CHROMIUM
14	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
13	MG/KG	NICKEL
490	MG/KG	LEAD
4.0J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
7.5U	MG/KG	TIN
74	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
140	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
36	MG/KG	VANADIUM
29	MG/KG	YTTRIUM
50	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
23000	MG/KG	ALUMINUM
1400	MG/KG	MANGANESE
16000	MG/KG	CALCIUM
2100	MG/KG	MAGNESIUM
32000	MG/KG	IRON
NA	MG/KG	SODIUM
2800	MG/KG	POTASSIUM
22	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced By: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 11:35
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G12S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
4.0U	MG/KG	SILVER
15	MG/KG	ARSENIC
NA	MG/KG	BORON
220	MG/KG	BARIUM
2.5	MG/KG	BERYLLIUM
1.9	MG/KG	CADMIUM
18	MG/KG	COBALT
34	MG/KG	CHROMIUM
15	MG/KG	COPPER
4.0U	MG/KG	MOLYBDENUM
15	MG/KG	NICKEL
680	MG/KG	LEAD
4.8J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
10	MG/KG	TIN
110	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
210	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
48	MG/KG	VANADIUM
46	MG/KG	YTTRIUM
58	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
2000	MG/KG	MANGANESE
26000	MG/KG	CALCIUM
1900	MG/KG	MAGNESIUM
55000	MG/KG	IRON
NA	MG/KG	SODIUM
2300	MG/KG	POTASSIUM
17	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 3941 FY 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G13S /
Media: SEDIMENT

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 11:50
Ending:

RESULTS	UNITS	ANALYTE
8.0U	MG/KG	SILVER
40	MG/KG	ARSENIC
NA	MG/KG	BORON
360	MG/KG	BARIUM
5.5	MG/KG	BERYLLIUM
3.2	MG/KG	CADMIUM
NA	MG/KG	COBALT
59	MG/KG	CHROMIUM
11	MG/KG	COPPER
8.0U	MG/KG	MOLYBDENUM
23	MG/KG	NICKEL
530	MG/KG	LEAD
4.2J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
20U	MG/KG	TIN
180	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
170	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
110	MG/KG	VANADIUM
57	MG/KG	YTTRIUM
69	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
22000	MG/KG	ALUMINUM
3600	MG/KG	MANGANESE
33000	MG/KG	CALCIUM
1700	MG/KG	MAGNESIUM
150000	MG/KG	IRON
NA	MG/KG	SODIUM
1900	MG/KG	POTASSIUM
26	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 3042 FY 1998 Project: 98-0337

Produced By: Wasko, Mike

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G14S /
Media: SEDIMENT

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 12:00
Ending:

RESULTS	UNITS	ANALYTE
5.0U	MG/KG	SILVER
23	MG/KG	ARSENIC
NA	MG/KG	BORON
210	MG/KG	BARIUM
3.7	MG/KG	BERYLLIUM
2.5U	MG/KG	CADMIUM
NA	MG/KG	COBALT
40	MG/KG	CHROMIUM
10	MG/KG	COPPER
5.0U	MG/KG	MOLYBDENUM
17	MG/KG	NICKEL
320	MG/KG	LEAD
3.5J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
12U	MG/KG	TIN
140	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
150	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
70	MG/KG	VANADIUM
46	MG/KG	YTTRIUM
51	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
19000	MG/KG	ALUMINUM
2600	MG/KG	MANGANESE
23000	MG/KG	CALCIUM
1500	MG/KG	MAGNESIUM
88000	MG/KG	IRON
NA	MG/KG	SODIUM
2000	MG/KG	POTASSIUM
27	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Project: 98-0557

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 12:15
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G15S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
10U	MG/KG	SILVER
61	MG/KG	ARSENIC
NA	MG/KG	BORON
580	MG/KG	BARIUM
6.4	MG/KG	BERYLLIUM
5.0U	MG/KG	CADMIUM
NA	MG/KG	COBALT
50	MG/KG	CHROMIUM
25	MG/KG	COPPER
10U	MG/KG	MOLYBDENUM
30	MG/KG	NICKEL
4000	MG/KG	LEAD
66J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
70	MG/KG	TIN
160	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
150	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
140	MG/KG	VANADIUM
53	MG/KG	YTTRIUM
98	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
21000	MG/KG	ALUMINUM
7800	MG/KG	MANGANESE
48000	MG/KG	CALCIUM
2600	MG/KG	MAGNESIUM
210000	MG/KG	IRON
NA	MG/KG	SODIUM
2000U	MG/KG	POTASSIUM
15	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 5544 FT 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G16S /
Media: SURFACE SOIL (0" - 12")

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 14:20
Ending:

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
18	MG/KG	ARSENIC
NA	MG/KG	BORON
140	MG/KG	BARIUM
1.6	MG/KG	BERYLLIUM
160	MG/KG	CADMIUM
NA	MG/KG	COBALT
33	MG/KG	CHROMIUM
52	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
28	MG/KG	NICKEL
1600	MG/KG	LEAD
12J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
7.5U	MG/KG	TIN
68	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
200	MG/KG	TITANIUM
8.3	MG/KG	THALLIUM
37	MG/KG	VANADIUM
28	MG/KG	YTTRIUM
250	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
24000	MG/KG	ALUMINUM
1200	MG/KG	MANGANESE
15000	MG/KG	CALCIUM
2200	MG/KG	MAGNESIUM
30000	MG/KG	IRON
NA	MG/KG	SODIUM
3000	MG/KG	POTASSIUM
35	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 14:30
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G17S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
4.0U	MG/KG	SILVER
120	MG/KG	ARSENIC
NA	MG/KG	BORON
440	MG/KG	BARIUM
2.0U	MG/KG	BERYLLIUM
20	MG/KG	CADMIUM
15	MG/KG	COBALT
44	MG/KG	CHROMIUM
250	MG/KG	COPPER
4.0U	MG/KG	MOLYBDENUM
39	MG/KG	NICKEL
7700	MG/KG	LEAD
92J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
190	MG/KG	TIN
85	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
250	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
36	MG/KG	VANADIUM
28	MG/KG	YTTRIUM
240	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
22000	MG/KG	ALUMINUM
1400	MG/KG	MANGANESE
19000	MG/KG	CALCIUM
2300	MG/KG	MAGNESIUM
58000	MG/KG	IRON
NA	MG/KG	SODIUM
2500	MG/KG	POTASSIUM
16	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 3540 FY 1998 Project: 98-0557

Produced By: Wasko, Mike

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G18S /
Media: SEDIMENT

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 14:45
Ending:

RESULTS	UNITS	ANALYTE
4.0U	MG/KG	SILVER
54	MG/KG	ARSENIC
NA	MG/KG	BORON
140	MG/KG	BARIUM
2.4	MG/KG	BERYLLIUM
23	MG/KG	CADMIUM
16	MG/KG	COBALT
21	MG/KG	CHROMIUM
67	MG/KG	COPPER
4.0U	MG/KG	MOLYBDENUM
20	MG/KG	NICKEL
11000	MG/KG	LEAD
94J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
72	MG/KG	TIN
70	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
140	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
30	MG/KG	VANADIUM
61	MG/KG	YTTRIUM
160	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.090	MG/KG	TOTAL MERCURY
31000	MG/KG	ALUMINUM
910	MG/KG	MANGANESE
19000	MG/KG	CALCIUM
2000	MG/KG	MAGNESIUM
34000	MG/KG	IRON
NA	MG/KG	SODIUM
1900	MG/KG	POTASSIUM
90	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G19S /
Media: SURFACE SOIL (0" - 12")

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 15:00
Ending:

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
22	MG/KG	ARSENIC
NA	MG/KG	BORON
140	MG/KG	BARIUM
1.5U	MG/KG	BERYLLIUM
16	MG/KG	CADMIUM
NA	MG/KG	COBALT
22	MG/KG	CHROMIUM
56	MG/KG	COPPER
3.0U	MG/KG	MOLYBDENUM
16	MG/KG	NICKEL
4100	MG/KG	LEAD
22J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
17	MG/KG	TIN
52	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
120	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
28	MG/KG	VANADIUM
23	MG/KG	YTTRIUM
83	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.050U	MG/KG	TOTAL MERCURY
22000	MG/KG	ALUMINUM
1100	MG/KG	MANGANESE
11000	MG/KG	CALCIUM
2300	MG/KG	MAGNESIUM
24000	MG/KG	IRON
NA	MG/KG	SODIUM
3300	MG/KG	POTASSIUM
35	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample: 3048 FF 1998 Project: 98-0357

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 15:10
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G20S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
3.0U	MG/KG	SILVER
17	MG/KG	ARSENIC
NA	MG/KG	BORON
160	MG/KG	BARIUM
1.5U	MG/KG	BERYLLIUM
3.1	MG/KG	CADMIUM
NA	MG/KG	COBALT
28	MG/KG	CHROMIUM
49	MG/KG	COPPER
6.0U	MG/KG	MOLYBDENUM
13	MG/KG	NICKEL
7100	MG/KG	LEAD
31J	MG/KG	ANTIMONY
5.0U	MG/KG	SELENIUM
13	MG/KG	TIN
72	MG/KG	STRONTIUM
NA	MG/KG	TELLURIUM
160	MG/KG	TITANIUM
1.0U	MG/KG	THALLIUM
30	MG/KG	VANADIUM
22	MG/KG	YTTRIUM
64	MG/KG	ZINC
NA	MG/KG	ZIRCONIUM
0.052	MG/KG	TOTAL MERCURY
20000	MG/KG	ALUMINUM
1100	MG/KG	MANGANESE
12000	MG/KG	CALCIUM
1900	MG/KG	MAGNESIUM
26000	MG/KG	IRON
NA	MG/KG	SODIUM
2400	MG/KG	POTASSIUM
21	%	% MOISTURE

LOW MATRIX SPIKE RECOVERY ON ANTIMONY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Project: 98-0557

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G6S /
Media: SEDIMENT

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 09:25
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.020U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
0.16U	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 5935 FY 1998 Project: 98-0557

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G7S /
Media: SEDIMENT

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:10
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.020U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
0.20	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G8S /
Media: SUBSURFACE SOIL (> 12")

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:20
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.020U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
0.16U	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Processed By: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:30
Ending:

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G9S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.025U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
1.0	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

iverage value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
ictual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
ic indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
:onfirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 3958 FY 1998 Project: 98-0557

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G10S /
Media: SURFACE SOIL (0" - 12")

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 10:45
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.020U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
0.16U	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G12S /
Media: SURFACE SOIL (0" - 12")

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 11:35
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
1.0U	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.020U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
0.16U	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced By: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 12:15
Ending:

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G15S /
Media: SEDIMENT

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
0.56	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.050U	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
1.6	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G16S /
Media: SURFACE SOIL (0" - 12")

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 14:20
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
0.47	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
1.9	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.10	MG/L	NICKEL
1.4	MG/L	LEAD
0.29	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 5945 FY 1998 Project: 98-0557

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN

Program: RCRA

Id/Station: G17S /

Media: SURFACE SOIL (0" - 12")

Produced by: Wasko, Mike

Requestor:

Project Leader: WDAVIS

Beginning: 07/08/98 14:30

Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
0.75	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.17	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
6.4	MG/L	LEAD
0.20	MG/L	ANTIMONY
0.35U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G18S /
Media: SEDIMENT

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 14:45
Ending:

RESULTS	UNITS	ANALYTE
NA	MG/L	SILVER
NA	MG/L	ARSENIC
NA	MG/L	BARIUM
NA	MG/L	BERYLLIUM
NA	MG/L	CADMIUM
NA	MG/L	CHROMIUM
NA	MG/L	NICKEL
NA	MG/L	LEAD
NA	MG/L	ANTIMONY
NA	MG/L	SELENIUM
NA	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

INSUFFICIENT SAMPLE FOR TCLP EXTRACTION

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G19S /
Media: SURFACE SOIL (0" - 12")

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 15:00
Ending:

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
0.45	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.15	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
3.6	MG/L	LEAD
0.16U	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced By: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 15:10
Ending:

METALS TCLP SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G20S /
Media: SURFACE SOIL (0" - 12")

RESULTS	UNITS	ANALYTE
0.040U	MG/L	SILVER
0.30U	MG/L	ARSENIC
0.60	MG/L	BARIUM
0.020U	MG/L	BERYLLIUM
0.043	MG/L	CADMIUM
0.040U	MG/L	CHROMIUM
0.080U	MG/L	NICKEL
22	MG/L	LEAD
0.29	MG/L	ANTIMONY
0.34U	MG/L	SELENIUM
0.40U	MG/L	THALLIUM
NA	MG/L	TOTAL MERCURY

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/07/98 08:15
Ending:

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G1W /
Media: SURFACE WATER

RESULTS	UNITS	ANALYTE
0.50U	UG/L	SILVER
1.0U	UG/L	ARSENIC
NA	UG/L	BORON
32	UG/L	BARIUM
0.10U	UG/L	BERYLLIUM
0.20U	UG/L	CADMIUM
0.50U	UG/L	COBALT
0.50U	UG/L	CHROMIUM
0.69	UG/L	COPPER
0.50U	UG/L	MOLYBDENUM
0.50U	UG/L	NICKEL
0.50U	UG/L	LEAD
0.10U	UG/L	ANTIMONY
0.50U	UG/L	SELENIUM
1.0U	UG/L	TIN
120	UG/L	STRONTIUM
0.50U	UG/L	TELLURIUM
5.0U	UG/L	TITANIUM
0.10U	UG/L	THALLIUM
1.0U	UG/L	VANADIUM
0.50U	UG/L	YTTRIUM
4.4	UG/L	ZINC
NA	UG/L	ZIRCONIUM
0.2U	UG/L	TOTAL MERCURY
240	UG/L	ALUMINUM
47	UG/L	MANGANESE
67	MG/L	CALCIUM
5.2	MG/L	MAGNESIUM
0.12	MG/L	IRON
5.1	MG/L	SODIUM
2.4	MG/L	POTASSIUM

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

Sample 5929 FY 1998 Project: 98-0557

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G2W /
Media: SURFACE WATER

Produced by: Wasko, Mike
Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 08:00
Ending:

RESULTS	UNITS	ANALYTE
0.50U	UG/L	SILVER
1.0U	UG/L	ARSENIC
NA	UG/L	BORON
30	UG/L	BARIUM
0.10U	UG/L	BERYLLIUM
0.20U	UG/L	CADMIUM
0.50U	UG/L	COBALT
0.50U	UG/L	CHROMIUM
0.66	UG/L	COPPER
0.50U	UG/L	MOLYBDENUM
0.50U	UG/L	NICKEL
3.3	UG/L	LEAD
0.39	UG/L	ANTIMONY
0.50U	UG/L	SELENIUM
1.0U	UG/L	TIN
110	UG/L	STRONTIUM
0.50U	UG/L	TELLURIUM
5.0U	UG/L	TITANIUM
0.10U	UG/L	THALLIUM
1.0U	UG/L	VANADIUM
0.50U	UG/L	YTTRIUM
5.3	UG/L	ZINC
NA	UG/L	ZIRCONIUM
0.2U	UG/L	TOTAL MERCURY
260	UG/L	ALUMINUM
67	UG/L	MANGANESE
62	MG/L	CALCIUM
6.2	MG/L	MAGNESIUM
0.19	MG/L	IRON
4.7	MG/L	SODIUM
2.8	MG/L	POTASSIUM

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: G3W /
Media: SURFACE WATER

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 08:45
Ending:

RESULTS	UNITS	ANALYTE
0.50U	UG/L	SILVER
1.0U	UG/L	ARSENIC
NA	UG/L	BORON
29	UG/L	BARIUM
0.10U	UG/L	BERYLLIUM
0.21	UG/L	CADMIUM
0.50U	UG/L	COBALT
0.50U	UG/L	CHROMIUM
0.64	UG/L	COPPER
0.50U	UG/L	MOLYBDENUM
0.50U	UG/L	NICKEL
3.2	UG/L	LEAD
0.44	UG/L	ANTIMONY
0.50U	UG/L	SELENIUM
1.0U	UG/L	TIN
110	UG/L	STRONTIUM
0.50U	UG/L	TELLURIUM
5.0U	UG/L	TITANIUM
0.10U	UG/L	THALLIUM
1.0U	UG/L	VANADIUM
0.50U	UG/L	YTTRIUM
5.2	UG/L	ZINC
NA	UG/L	ZIRCONIUM
0.2U	UG/L	TOTAL MERCURY
300	UG/L	ALUMINUM
45	UG/L	MANGANESE
61	MG/L	CALCIUM
5.7	MG/L	MAGNESIUM
0.18	MG/L	IRON
4.6	MG/L	SODIUM
2.7	MG/L	POTASSIUM

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

METALS SCAN

Facility: General Smelting and Refining, College Grove,, TN
Program: RCRA
Id/Station: QA001PB /
Media: METALSBLK

Requestor:
Project Leader: WDAVIS
Beginning: 07/08/98 16:00
Ending:

RESULTS	UNITS	ANALYTE
0.50U	UG/L	SILVER
1.0U	UG/L	ARSENIC
NA	UG/L	BORON
0.50U	UG/L	BARIUM
0.10U	UG/L	BERYLLIUM
0.20U	UG/L	CADMIUM
0.50U	UG/L	COBALT
0.50U	UG/L	CHROMIUM
0.50U	UG/L	COPPER
0.50U	UG/L	MOLYBDENUM
0.50U	UG/L	NICKEL
2.1	UG/L	LEAD
0.10U	UG/L	ANTIMONY
0.50U	UG/L	SELENIUM
1.0U	UG/L	TIN
0.50U	UG/L	STRONTIUM
0.50U	UG/L	TELLURIUM
5.0U	UG/L	TITANIUM
0.10U	UG/L	THALLIUM
1.0U	UG/L	VANADIUM
0.50U	UG/L	YTTRIUM
3.9	UG/L	ZINC
NA	UG/L	ZIRCONIUM
0.2U	UG/L	TOTAL MERCURY
50U	UG/L	ALUMINUM
0.50U	UG/L	MANGANESE
0.050U	MG/L	CALCIUM
0.020U	MG/L	MAGNESIUM
0.020U	MG/L	IRON
0.50U	MG/L	SODIUM
0.020U	MG/L	POTASSIUM

A-average value. NA-not analyzed. NAI-interferences. J-estimated value. N-presumptive evidence of presence of material.
K-actual value is known to be less than value given. L-actual value is known to be greater than value given. U-material was analyzed for but not detected. the number is the minimum quantitation limit.
R-qc indicates that data unusable. compound may or may not be present. resampling and reanalysis is necessary for verification.
C-confirmed by gcms: 1.when no value is reported, see chlordane constituents 2.constituents or metabolites of technical chlordane

TN0028827
Franklin

HRWA's Draft Permits Comments re:Franklin/Lynwood/Cartwright Ck
Gary Davis
to:
Connie Kagey
12/22/2009 09:06 AM
Show Details

Connie
Attached are HRWA's comment (ltr w/8 attachments) - may require several emails
Thanks
Gary
note: ltr + Att 1 attached to this email

2 attachments

GND a

HARPETH RIVER WATERSHED ASSOCIATION

December 1, 2009

Mr. Gary Davis
Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex
401 Church Street
Nashville, Tennessee 37243

Re: Draft NPDES permits:
Franklin STP, TN0028827: Lynwood Utilities STP, TN0029718:
Cartwright Creek LLC – Grassland STP, TN0027278

Dear Mr. Davis,

Thank you for accommodating our request in October to extend the comment period until December 1 to enable us to compile our materials and analyses to provide to the department on these proposed permits. Please incorporate all of the attachments provided with this summary into our comments for the record. Also, HRWA signs onto the comments provided by the Tennessee Clean Water Network as they have signed onto ours in order to provide the department with comprehensive input without duplicating effort. TCWN has included review of the three permits by Dr. Joann Burkholder, an aquatic ecologist, who is the director of the Center for Applied Aquatic Ecology at NC State University. HRWA has included an analysis and calculations of the pollution load the river can handle based on the TMDL principles and current field conditions from Mike Corn, President of Aquaeter, an environmental engineering firm with extensive experience in TMDLs and water quality.

In addition to these comments I would like to reiterate our request for a joint public hearing on the three proposed permits. Having worked with the department on prior permit renewals (Lynwood and Franklin) and the ARAP permit for a withdrawal regime for Franklin's drinking water plant, I would like to suggest that the joint public hearing be set in January after the public hearings on the triennial review of the water quality standards. In consideration of the holiday season as well, setting a public hearing for late January will enable more public attendance to learn and provide input.

These three sewage treatment plants (STP) discharge directly into the Harpeth River within a 17 mile stretch of one another in the upper third of the watershed. The receiving waters are impaired as a result of low dissolved oxygen levels, nutrients and

P.O. Box 1127 ▪ Franklin, Tennessee 37065 ▪ Phone: 615-790-9767 ▪ Facsimile: 615-790-9767 ▪ www.harpethriver.org

phosphates according to TDEC's 2008 303(d) list. Franklin's STP, with a design flow of 12 MGD (million gallons a day), is the largest point source discharger in the entire 872 square mile watershed, and is classified as a major discharger. At this time, the facility is operating at about half that capacity. The other two STPs, though significantly smaller as minor dischargers, are not far downstream. The EPA completed a TMDL for Nutrient Enrichment/Low Dissolved Oxygen in 2004 that applied to the Harpeth from the headwaters down to the mainstem's confluence with the Little Harpeth at the Williamson County line.

Violations of the state's dissolved oxygen standard in the Harpeth occur during the summer when the river naturally has its low flow summer season. Data gathered by the EPA, TDEC, HRWA, and consultants in studies related to various permit issues on the Harpeth have documented low dissolved oxygen levels as far downstream as the Harpeth River State Park in Cheatham County. The Harpeth River is listed on the 303(d) for low dissolved oxygen all the way downstream to the confluence with the South Harpeth in Cheatham County. These violations are occurring in two Tier II sections of the Harpeth River: the state scenic river section in Davidson County, and the adjacent downstream section in Cheatham County adjacent to the number properties that comprise the Harpeth River State Park. The attachments include four different dissolved oxygen studies of the Harpeth River that HRWA has conducted since 2002 with various partners and supporters. The two most extensive in 2006 and 2007 were coordinated with TDEC field staff with the study in 2007 funded in part by the TN Wildlife Resources Agency.

A number of analyses have been done that have built on and relooked at key aspects of the EPA's TMDL(Attachments 6 and 7). In addition to the mainstem's dissolved oxygen studies, HRWA has funded analyses, completed an EPA grant with Franklin and Williamson County as partners, and received several state 319 stream restoration grant that have encompassed the following: watershed plans and stream restoration in the headwaters, bacterial surveys and efforts toward addressing failing septic in the headwaters, effluent domination of the river's flow in the summer downstream from Franklin, industrial chemical oxygen demand just upstream from Franklin's discharge by contaminated groundwater from Egyptian Lacquer, effect on the river's assimilative capacity from water withdrawals, and the use of site level stormwater runoff tools to reduce stormwater runoff contributions from development.

A key finding from several years of summer dissolved oxygen monitoring is that the Harpeth River does not meet the state water quality D.O. standard upstream from the first permitted sewage treatment plant. Data gathered measured times when the river was below state standards upstream of each of these permitted discharge points. Based on analysis funded by HRWA, at times when the river's dissolved oxygen levels were significantly below standards, the river's flow below Franklin was 50% or more of treated effluent that was then added to by the two downstream STP dischargers. Dissolved oxygen levels slowly increased and were above or close to the state standard in the Harpeth over 30 miles downstream from the Cartwright Creek outfall in Cheatham County where the river's flow was ten times or more what it is through the Franklin and

northern Williamson County area. (See attachmen 8 for a short summary or the actual reports in attachments 2-7).

Thus, the Harpeth River in the summer season is violating water quality standards for dissolved oxygen when the city of Franklin's plant is discharging at less than half of its permitted design capacity with a very highly treated effluent that is well within the permit limits. From a review of Franklin's DMRs, the plant's effluent is consistently at a BOD_5 of 2 mg/l or less. The proposed permit limit for BOD_5 in the renewal is 4 mg/l which is based on the TMDL. At Franklin's design flow of 12 MGD, this is significantly MORE pounds of oxygen demand than the city currently discharges and the river does not currently meet the state water quality standards under these current conditions. This is the same for the other two permits. These field data findings essentially point to issues with key assumptions in the TMDL, and that it is time for investment in a new TMDL model. (Attachment 6-7).

Field data and analysis provided with these and TCWN's comments all indicate that the Harpeth River is not meeting water quality standards, especially dissolved oxygen, because of effluent discharges from these facilities. The Harpeth river's flow in the summer is so low that permitted effluent discharges can easily make up a significant percent of the river's flow (specific estimates provided in attachments 6-7). To quote Dr. Burkholder in her comments, the Franklin STP with a design flow of 12 MGD "can 'swamp' the natural flow of the stream (low flow 7Q10 is only 0.49 MGD)." Though Franklin's design flow is the largest, because of the river's summer low-flow conditions, both the much smaller Lynwood and Cartwright Creek sewer plants also contribute enough pollutant load to continue to reduce oxygen levels and add nutrients that feed algal growth in the river. Lynwood at 0.4 MGD contributes about 14% of the river's flow when the Harpeth is at low flow, 7Q10 conditions of 2.77 MGD. Cartwright Creek, though the smallest at 0.25 MGD, has such significant inflow/infiltration problems with its collection system, that its effluent flow is nearly double that. So, even this small sewer plant when compared to the large upstream Franklin facility still contributes around 10% to the river's flow during 7Q10, low-flow conditions (2.86 MGD in the river).

As Dr. Burkholder states for the Lynwood and Cartwright Creek permits, "discharge from the STP under its new permit will continue to contribute substantially to the nutrient/eutrophication-related impairment for the receiving segment of this 303(d) listed stream." She states the same thing for Franklin's permit: "discharge .... will continue to significantly influence" the Harpeth.

The analysis provided in the attachment to our comments from Aquaeter (attachment 1) come to the same conclusion based on TMDL pollutant load calculations for oxygen demand. Using the TMDL equation that requires a margin of safety, incorporating pollutant loading from nonpoint sources, and using the specific data derived from the EPA in its TMDL, the amount of pollutant load the Harpeth can assimilate at the point of Franklin's outfall is 130 lbs/day of BOD (biological oxygen demand.) EPA's TMDL in comparison is four times higher at 427 lbs/day. Aqueater's

work is based on existing conditions in the Harpeth, whereas the EPA's TMDL made a significant assumption that the river in the summer would be above state standard of 5 mg/l. (The TMDL used 6 mg/l). With existing conditions, that include a 300 lb/day pollutant load from the Egyptian Lacquer chemical input from contaminated groundwater, 130 lbs/day is all there is in the Harpeth for the existing three sewer plants. This is significantly less than the proposed permits would allow.

Based on the field data and analyses summarized above, the draft permits appear to violate the Clean Water Act and the TN Water Quality Control Act by not setting permit limits so that water quality standards are met in the receiving stream--the Harpeth (see citations in TCWN comments). In addition, permits can not be authorized when "conditions of the permit do not provide for compliance with the applicable requirements of the CWA or regulations promulgated under CWA" (40 CFR Part D section 122.4 (a) and (d) and TWQCA 1200-4-5-.04(f)).

HRWA applauds the department in working on a watershed basis in these permit renewals. For the Harpeth river, this is the first time the 3 sewage treatment plants in Williamson County will have their permits synchronized for renewal. This enables TDEC for the first time to have all the permit holders, sister agencies, private sector experts, non-profit organizations, and the public focusing on establishing a solution and/or a process for finding a solution that the permits can drive that will result in the Harpeth meeting the state dissolved oxygen water quality standard in the near future.

A key to this will be Franklin's work on its new Integrated Water Resources Plan (IWRP) which will be integrating stormwater runoff, effluent discharge, effluent reuse, and water withdrawal for drinking water. The city of Franklin has also set goals in its sustainability plan for a reduction in the flow of treated effluent into the Harpeth during the summer low flow season. Williamson County has taken a lead role in addressing failing septic systems in neighborhoods around Lynwood STP. Both this sewer plant and Franklin will be receiving the sewage from over 400 currently septic served homes that will reduce the nutrient enrichment into Lynwood Creek that is also listed on the 303(d) list.

Comments Applicable to all three proposed permits:

1. Based on current conditions in the Harpeth, less effluent discharge in volume and in concentration of pollutants needs to be instituted for the low-flow summer season what is in the proposed permits. A waste load allocation and TMDL needs to be redone for the Harpeth. This can be put in motion as part of Franklin's insightful IWRP initiative. Also, Franklin should not shoulder all the work and cost for developing a WLA for the Harpeth all by itself both in terms of analysis and monitoring. Though, clearly Franklin will take the lead and will likely become the regional sewer system since it has a highly functioning STP that can meet tight effluent limits cost effectively and has already put integrated water management schemes into play, such as effluent reuse.

2. Aquaeter's comments offer an interim WLA for which to finalize the proposed permits for their short term period to the end of November 2011 that would apply for the summer, low-flow season. Establishing a waste load for the Harpeth in the vicinity of the discharges forms the foundation of a watershed based permit. Franklin can currently meet a 130 lbs/day load allocation in the summer since its effluent CBOD5 is very clean at just under 2 mg/l. At a 6 MGD flow, which is what the facility currently produces, and its current BOD5, the Franklin STP could meet this pollutant load. But, it would mean no discharge in the summer for Lynwood and Cartwright Creek (which wasn't even factored into the EPA TMDL.) Franklin in the summer season has been sending 3 -4 MGD of its effluent to irrigation reuse which does not get discharged into the Harpeth. With Franklin's effluent reuse that is already in place, there is some pollutant load that can be allocated to the two other sewer plants in the summer for the short term duration of these permits.

3. Along the same lines of moving to watershed based permitting, all 3 proposed permits need the same effluent concentrations. For example, the proposed permits right now have Franklin with a tighter BOD5 than the other two, and Lynwood with the tightest TN. All 3 have different proposed TP effluent limits too.

4. The Harpeth River segments that all 3 STPs discharge into does not meet water quality standards in the summer predominantly because of effluent discharge. Each permit at the beginning of the rationale section instead says the "division considers these conditions to be due primarily to non-point discharges rather than the permittee's treated wastewater discharge." The field data and analyses presented in these comments and the EPA's TMDL refutes this. The rationale statement needs to be edited.

5. Each permit needs language that is similar to what is found in other TDEC permits, such as the construction general permit: "This permit does not authorize discharges that would result in violation of a state water quality standard."

6. Each proposed permit dropped the TMDL reopener clause. Is there other language that accomplishes the same intent? If not, we suggest it be put back in these permits.

7. TDEC should test each facility's effluent quarterly as an independent duplicate sample when the permittee does it. The permittee can pay for this cost. This test would be used to derive the CBODu/BOD5 ratio.

8. The permits should establish a goal or two for the Integrated Water Management Plan that Franklin has just begun so that the effort which is intended to improve water quality in the Harpeth produces analysis relevant for all 3 permittees. One goal would be to establish a waster load allocation for the Harpeth. Another goal needs to be to require that Lynwood and Cartwright Creek participate and bring some funding to the effort. (See item #9 and #10 below).

Lynwood and Cartwright Creek permits:

9. The permits for Lynwood and Cartwright Creek need to require their participation and some funding that they bring to Franklin's IWRP process so that all the permittees are involved. The possible scenarios for an implementation plan for a TMDL on the Harpeth for low dissolved oxygen will need to involve all 3 sewer plants. The 3 sewer plant utilities, the city of Franklin and Williamson County have all had discussions already as the northern Williamson County area looks at regional sewer solutions.

10. Both permits need to also require the similar receiving stream investigations that are in Franklin's proposed permit. This might be the best way to essentially have all 3 permittees involved in the IWRP and combing resources for water quality data that is needed for developing a waste load allocation/new TMDL for the Harpeth for low dissolved oxygen and nutrient enrichment.

11. Lynwood's reserve sewer capacity was a significant step by TDEC when the facility was approved for expansion to address adjacent neighborhoods with failing septic systems. Williamson County leadership have spent considerable effort to now have the sewer hook systems underway. Some of the neighborhoods will actually now be served by Franklin. This is a major step toward regional sewer integration in this area. But, it is critical to keep this reserve capacity in place. Prior analysis provided by HRWA to the department two years ago when the utility wanted to accept almost 430 new homes found that it would be hard for Lynwood to meet its current permit limits as it comes closer to its design capacity as these septic homes are hooked up. We recommend keeping the reserve in place, regardless of the status of the septic hook-up program, since at Lynwood's current operation the river is not meeting standards in the summer.

12. The neighborhood in which Lynwood sits has complained again about odor. What can the department do with regard to the proposed permit to address this problem? The Cottonwood development layout that this facility was originally built for did not provide any buffering space for the facility.

13. Cartwright Creek has a significant I/I problem that the department recognizes in the draft permit (page R2). This significant increase in rain and groundwater into the facility is compromising the treatment according to the draft permit. The proposed permit does not have specifics as to how the utility will address this which needs to be done. This issue should be part of the IWRP so that these costs are incorporated in alternatives analysis that the project will be developing.

This permit renewal is really the beginning of developing a comprehensive plan for the mainstem of the Harpeth River so that it meets water quality standards during the summer low flow season. HRWA has been playing a significant role in collaborating with various state and federal agencies, working with the sewage treatment plant permittees, and brining in private outside TMDL experts to help contribute to creating the

framework for a cost effective plan for sewage management for the large growth area of the Harpeth River watershed so that the Harpeth will meet water quality standards as soon as possible. HRWA will be part of the stakeholder group of the IWRP that has its first meeting December 17.

HRWA would like to convene a gathering of all the permit holders, their consultants, other agency experts, TDEC, and any other interested parties to host a presentation and discussion of all the dissolved oxygen data. HRWA will offer this as part of the something we can bring to the IWRP effort. Please do not hesitate to contact me with any questions on these comments and I look forward to working with all the stakeholders.

Sincerely,

Dorie Bolze

Dorie Bolze
Executive Director
(615) 790-9767 ext. 101
(615) 479-0181 (c)

Cc: Paul Sloan, Deputy Director, TDEC
Paul Davis, Director, Water Pollution Control, TDEC
Vojin Janjic, Permit Section, Water Pollution Control, TDEC
Saya Qualls, TDEC
Mark Hilty, City of Franklin director of Water and Sewer
Tyler Ring, president, Lynwood Utility District
Bruce Myers, regional manager, Cartwright Creek LLC
Dave McKinney and staff, TWRA
Steve Alexander, US Fish and Wildlife Service, Cookeville
Rogers Anderson, Williamson County mayor
John Schroer, city of Franklin mayor
Bill Melville, EPA
Tom McGill, EPA
Mark Nuhfer, EPA

Attachments:

Below is a list of the attachments and a brief description of their relevance. Some are on the HRWA web site (under Library/Scientific Studies), so their location is supplied so they can be printed out for the file. Most of these documents you and others in the department have received already. I will mail you a printed set as well. Please contact HRWA for copies of any of these attachments.

1. **Comments on the Harpeth River Watershed NDPES Permits,** by Aquaeter to Harpeth River Watershed Association, Nov. 25, 2009

This memo includes calculations of the waste load allocation based on current river conditions that can be established now to apply for all 3 permits for summer low-flow season discharges until a TMDL is redone.

2. **Dissolved Oxygen in the Harpeth River: August-September 2006. Final.** Harpeth River Watershed Association. Bolze, Cain, and McFadden. Feb. 2007.

http://www.harpethriver.org/library/library?id=55414

This report compiled Dissolved Oxygen data from various sources since the EPA's data for the TMDL in 2001 up to 2006. TDEC's diurnal monitoring data from 2002 and 2003 is in Appendix E. HRWA's first Dissolved Oxygen study from 2002 is Appendix F. The 2006 D.O. monitoring coordinated by HRWA and TDEC was comprised of 10 sampling sites, 3 of which were TDEC sites. Maps in the report help to locate all the sites along almost the entire mainstem from the headwaters to the take out point at the Harpeth River State Park. USGS data on flow during the monitoring is included as well.

3. **Dissolved Oxygen Study: June – July 2007. Final.** Harpeth River Watershed Association. By Cain and Bolze.

http://www.sitemason.com/files/bMJfB6/HRWA%20July%2007%20dissolved%20oxygen%20study%20final%20report.pdf

Eight sites were monitored in the segment of the Harpeth River through downtown Franklin to see if affects of dissolved oxygen could be captured from the chemically contaminated seeps into the Harpeth River and from seeps into Liberty Creek that flows into the Harpeth. The contaminated groundwater is from chemicals released by Egyptian Lacquer Manufacturing Company. The upmost site is above the lowhead dam , and the furthest downstream site is downstream of the Franklin STP outfall.

4. **Dissolved Oxygen in the Harpeth River: September 2007.** Harpeth River Watershed Association. By Cain and Bolze. (electronic file)

The report is complete but without a discussion section because the most recent version was corrupted. The file is a scan of a printed version. Figure 1 that displays all the site data is missing one site (#10 at RM 84.8), but the data from that site are in the report. Just like with the 2006 survey, TDEC placed diurnal monitoring probes at 3 of the sites. This year's survey was the most extensive in distance and in number of sites.

5. **Harpeth River Dissolved Oxygen Survey**: September 2008. Draft. (electronic file).

This file has all the data from this year's survey in an excel spreadsheet with a summary table. TDEC wasn't able to employ the monitoring probes this year since they were in use in another watershed for the state's five-year cycle. The sites this year begin at the site below the Franklin STP outfall and the furthest downstream is at the Highway 70 bridge in Cheatham County.

6. **Water Quality Analysis: Harpeth River Between Franklin and Kingston Springs, TN.** Aquaeter. By Corn and Corn. For Harpeth River Watershed Association. September 2006.

http://www.sitemason.com/files/faR5Vm/Water%20Quality%20Analysis.pdf

This analysis discusses key assumptions in the EPA's TMDL for low dissolved oxygen, has estimated percentages of river flows that are treated effluent, and has TDEC's diurnal D.O. data from 2002 and 2003. Key assumptions in the TMDL include that the river will be at 6 mg/l of D.O. before the first STP outfall.

7. **Dissolved Oxygen in the Harpeth River: Connecting Point Source, Nonpoint Source, and Water Withdrawals.** Presentation to the TN AWRA by Aquaeter and HRWA. By Corn, Corn, Bolze, and Davee. April 2008. Powerpoint. (electronic file)

The powerpoint has EPA's Dissolved Oxygen data chart from the TMDL from August 2000 (p. 12), river flow data from the 2006 HRWA Dissolved Oxygen survey, three charts from TDEC's diurnal monitoring from 2002 and 2003 with estimated ranges of effluent percentage (pgs 14-16), and a simple mass balance for the Harpeth river to derive the flow needed to assimilate the design capacity of the Franklin sewer plant. If the Harpeth river just upstream of the Franklin outfall is 6 mg/l, then 96 cfs of flow is needed to provide enough oxygen to assimilate the effluent at the design flow of 12 MGD and current effluent concentrations. On page 23 is Figure 18 from the EPA TMDL that indicates that the BOD concentration in Franklin's effluent needs to be 3 mg/l for a 12 MGD design flow to meet the river's D.O. standard of 5 mg/l. This is lower than the 4 mg/l recommended in the TMDL summary table.

8. **Two Memos via email by Dorene Bolze, Harpeth River Watershed Association, to EPA, USFWS, TWRA, USGS, Aquaeter, and others, on findings from Dissolved Oxygen surveys.** March 08, 2007 re 2006 Dissolved Oxygen study and July 19, 2007 re June 2007 Dissolved Oxygen study in Franklin area. (electronic file)

The memos provide a summary of results that found low dissolved oxygen levels in violation of state water quality standards upstream and downstream of the various sewage treatment plant outfalls. Memos point to analysis of percent of river flow that is treated effluent during the monitoring period. Also discussed are assumptions in the EPA's TMDL for low dissolved oxygen and D.O. drop tied to the seeps of chemicals in the groundwater from Egyptian Lacquer.

Attachment 1

AquAeTer

MEMORANDUM

TO: **Ms. Dorie Bolze, Harpeth River Watershed Agency**
CC:
FROM: Mike Corn, P.E. (TN) and John Michael Corn, P.E. (TN)
DATE: 11/25/2009
JOB NO.:
RE: **Comments on the Harpeth River Watershed NPDES Permits**

Ms. Bolze:

We have the following comments concerning the three permits out for public comment for the Harpeth River. Specifically, these NPDES Permits are for the following facilities:

1. City of Franklin STP, NPDES # TN0028827:
2. Lynnwood Utility Corp. STP, NPDES Permit # TN0028827; and
3. Cartwright Creek, LLC, NPDES Permit # TN0027278.

1. Franklin is planning on reusing their effluent for water supply (irrigation, car washes, golf courses, etc.). This eliminates Lynnwood's and Cartwright Creek's allocation since their allocation is dependent on effluent flow from Franklin. Deny reissuance of Lynnwood and Cartwright Creek's permits except for winter months. There is no allocation in the Harpeth River for these discharges without the full flow from the Franklin STP flow.
2. The USEPA TMDL for Franklin is based on 4 mg/L BOD_5 at 12 mgd. This represents a BOD_5 loading of 12 mgd * 4 mg/L * 8.34 = 400 lbs/day or 2,000 lbs/day of $CBOD_u$ (total oxygen demand to the River using the USEPA $CBOD_u/BOD_5$ ratio of 5.4:1). The USEPA model assumed a 6 mg/L background dissolved oxygen (DO) coming to the Franklin STP discharge point. Both TDEC and HRWA have monitored DO in the Harpeth River and have found that DO during low flow critical summertime conditions is around 3 mg/L or about ½ the DO concentration used by USEPA. Additionally, the volatile organic seeps entering the Harpeth River from Liberty Creek and directly into the Harpeth around the railroad track near Liberty Creek contributes around 250 to 300 lbs/day of oxygen demand to the River, which shows up in the low DO's in the Harpeth River coming to the Franklin STP.
3. The TMDL is the following:

   TMDL = WLA + LA + Safety Factor

   Where:
   WLA is point source discharges (Franklin POTW);
   LA = background loading which is around 250 to 300 lbs/day of $CBOD_u$;
   Safety Factor = based on unknown factors. In this case, a higher safety

factor would need to be used since the USEPA model was based on an arbitrary DO of 6 mg/L when actual measurements are about ½ this value. A 50% safety factor would be appropriate for this TMDL. The safety factors typically assigned to TMDLs can range from 10% to 50%. For this case the safety factor should be on the high side since USEPA used a background DO of 6 mg/L coming to Franklin POTW.

Therefore,

TMDL = WLA + LA + Safety Factor
WLA for Franklin = TMDL – LA – Safety Factor
WLA for Franklin = 2,000 lbs/day – 300 lbs/day – 1,000 lbs/day
WLA for Franklin = 700 lbs/day $CBOD_u$
WLA for Franklin = 700 lbs/day/5.4 = 130 lbs/day BOD_5.

WLA for Franklin = 130 lbs/day/(8.34*12 mgd) = 130 lbs/day/100.8
WLA for Franklin = 1.3 mg/L $CBOD_5$ for a flow of 12 mgd

Franklin's allocation should be 12 mgd * 1.3 mg/L * 8.34 = 130 lbs/day at a BOD_5 of 1.3 mg/L vs the proposed limit of 4 mg/L. Franklin is currently discharging about 6 mgd of effluent and the Franklin STP achieves an excellent BOD_5 discharge concentration of around 2 mg/L. The effluent $CBOD_5$ limit at 6 mgd is:

130 lbs/day/(6 mgd * 8.34) = 130/50 = 2.6 mg/L $CBOD_5$

4. The TMDL included the Franklin STP and Lynnwood Utility Corp. STP discharges, but did not include Cartwright Creek, LLC discharge. Therefore, any allocation given to Cartwright Creek must come from either Franklin or Lynnwood or be flow proportioned between the two. At present, there is no allocation for Cartwright Creek.
5. Since both Lynnwood and Cartwright Creek effluent limits are based on the 12 mgd flow coming from the Franklin STP and since there are documented DO standard violations downstream from all three of these discharge points, a reduction in allocation equivalent to the Franklin STP calculated allocation should be enforced for both Lynnwood and Cartwright Creek STPs. It is unclear if there is actually any allocation for either of these plants to discharge to the Harpeth River and the USEPA TMDL did not even include the Cartwright Creek discharge. The actual DO data from the Harpeth suggests that there is no allocation for these plants.

{In Archive} HRWA's Draft Permits Comments re:Franklin/Lynwood/Cartwright Ck

TN0028827

Gary Davis
to:
Connie Kagey
12/22/2009 09:06 AM
Hide Details
From: "Gary Davis" <Gary.Davis@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA

Archive: This message is being viewed in an archive.

2 Attachments

TN0028827 Draft Comments from HRWA Letter.pdf TN0028827 Draft Comments from HRWA Attachment 1.pdf

Connie
Attached are HRWA's comment (ltr w/8 attachments) - may require several emails
Thanks
Gary
note: ltr + Att 1 attached to this email

GND a

HARPETH RIVER WATERSHED ASSOCIATION

December 1, 2009

Mr. Gary Davis
Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex
401 Church Street
Nashville, Tennessee 37243

Re: Draft NPDES permits:
Franklin STP, TN0028827: Lynwood Utilities STP, TN0029718:
Cartwright Creek LLC – Grassland STP, TN0027278

Dear Mr. Davis,

Thank you for accommodating our request in October to extend the comment period until December 1 to enable us to compile our materials and analyses to provide to the department on these proposed permits. Please incorporate all of the attachments provided with this summary into our comments for the record. Also, HRWA signs onto the comments provided by the Tennessee Clean Water Network as they have signed onto ours in order to provide the department with comprehensive input without duplicating effort. TCWN has included review of the three permits by Dr. Joann Burkholder, an aquatic ecologist, who is the director of the Center for Applied Aquatic Ecology at NC State University. HRWA has included an analysis and calculations of the pollution load the river can handle based on the TMDL principles and current field conditions from Mike Corn, President of Aquaeter, an environmental engineering firm with extensive experience in TMDLs and water quality.

In addition to these comments I would like to reiterate our request for a joint public hearing on the three proposed permits. Having worked with the department on prior permit renewals (Lynwood and Franklin) and the ARAP permit for a withdrawal regime for Franklin's drinking water plant, I would like to suggest that the joint public hearing be set in January after the public hearings on the triennial review of the water quality standards. In consideration of the holiday season as well, setting a public hearing for late January will enable more public attendance to learn and provide input.

These three sewage treatment plants (STP) discharge directly into the Harpeth River within a 17 mile stretch of one another in the upper third of the watershed. The receiving waters are impaired as a result of low dissolved oxygen levels, nutrients and

P.O. Box 1127 ■ Franklin, Tennessee 37065 ■ Phone: 615-790-9767 ■ Facsimile: 615-790-9767 ■ www.harpethriver.org

phosphates according to TDEC's 2008 303(d) list. Franklin's STP, with a design flow of 12 MGD (million gallons a day), is the largest point source discharger in the entire 872 square mile watershed, and is classified as a major discharger. At this time, the facility is operating at about half that capacity. The other two STPs, though significantly smaller as minor dischargers, are not far downstream. The EPA completed a TMDL for Nutrient Enrichment/Low Dissolved Oxygen in 2004 that applied to the Harpeth from the headwaters down to the mainstem's confluence with the Little Harpeth at the Williamson County line.

Violations of the state's dissolved oxygen standard in the Harpeth occur during the summer when the river naturally has its low flow summer season. Data gathered by the EPA, TDEC, HRWA, and consultants in studies related to various permit issues on the Harpeth have documented low dissolved oxygen levels as far downstream as the Harpeth River State Park in Cheatham County. The Harpeth River is listed on the 303(d) for low dissolved oxygen all the way downstream to the confluence with the South Harpeth in Cheatham County. These violations are occurring in two Tier II sections of the Harpeth River: the state scenic river section in Davidson County, and the adjacent downstream section in Cheatham County adjacent to the number properties that comprise the Harpeth River State Park. The attachments include four different dissolved oxygen studies of the Harpeth River that HRWA has conducted since 2002 with various partners and supporters. The two most extensive in 2006 and 2007 were coordinated with TDEC field staff with the study in 2007 funded in part by the TN Wildlife Resources Agency.

A number of analyses have been done that have built on and relooked at key aspects of the EPA's TMDL(Attachments 6 and 7). In addition to the mainstem's dissolved oxygen studies, HRWA has funded analyses, completed an EPA grant with Franklin and Williamson County as partners, and received several state 319 stream restoration grant that have encompassed the following: watershed plans and stream restoration in the headwaters, bacterial surveys and efforts toward addressing failing septic in the headwaters, effluent domination of the river's flow in the summer downstream from Franklin, industrial chemical oxygen demand just upstream from Franklin's discharge by contaminated groundwater from Egyptian Lacquer, effect on the river's assimilative capacity from water withdrawals, and the use of site level stormwater runoff tools to reduce stormwater runoff contributions from development.

A key finding from several years of summer dissolved oxygen monitoring is that the Harpeth River does not meet the state water quality D.O. standard upstream from the first permitted sewage treatment plant. Data gathered measured times when the river was below state standards upstream of each of these permitted discharge points. Based on analysis funded by HRWA, at times when the river's dissolved oxygen levels were significantly below standards, the river's flow below Franklin was 50% or more of treated effluent that was then added to by the two downstream STP dischargers. Dissolved oxygen levels slowly increased and were above or close to the state standard in the Harpeth over 30 miles downstream from the Cartwright Creek outfall in Cheatham County where the river's flow was ten times or more what it is through the Franklin and

northern Williamson County area. (See attachmen 8 for a short summary or the actual reports in attachments 2-7).

Thus, the Harpeth River in the summer season is violating water quality standards for dissolved oxygen when the city of Franklin's plant is discharging at less than half of its permitted design capacity with a very highly treated effluent that is well within the permit limits. From a review of Franklin's DMRs, the plant's effluent is consistently at a BOD_5 of 2 mg/l or less. The proposed permit limit for BOD_5 in the renewal is 4 mg/l which is based on the TMDL. At Franklin's design flow of 12 MGD, this is significantly MORE pounds of oxygen demand than the city currently discharges and the river does not currently meet the state water quality standards under these current conditions. This is the same for the other two permits. These field data findings essentially point to issues with key assumptions in the TMDL, and that it is time for investment in a new TMDL model. (Attachment 6-7).

Field data and analysis provided with these and TCWN's comments all indicate that the Harpeth River is not meeting water quality standards, especially dissolved oxygen, because of effluent discharges from these facilities. The Harpeth river's flow in the summer is so low that permitted effluent discharges can easily make up a significant percent of the river's flow (specific estimates provided in attachments 6-7). To quote Dr. Burkholder in her comments, the Franklin STP with a design flow of 12 MGD "can 'swamp' the natural flow of the stream (low flow 7Q10 is only 0.49 MGD)." Though Franklin's design flow is the largest, because of the river's summer low-flow conditions, both the much smaller Lynwood and Cartwright Creek sewer plants also contribute enough pollutant load to continue to reduce oxygen levels and add nutrients that feed algal growth in the river. Lynwood at 0.4 MGD contributes about 14% of the river's flow when the Harpeth is at low flow, 7Q10 conditions of 2.77 MGD. Cartwright Creek, though the smallest at 0.25 MGD, has such significant inflow/infiltration problems with its collection system, that its effluent flow is nearly double that. So, even this small sewer plant when compared to the large upstream Franklin facility still contributes around 10% to the river's flow during 7Q10, low-flow conditions (2.86 MGD in the river).

As Dr. Burkholder states for the Lynwood and Cartwright Creek permits, "discharge from the STP under its new permit will continue to contribute substantially to the nutrient/eutrophication-related impairment for the receiving segment of this 303(d) listed stream." She states the same thing for Franklin's permit: "discharge .... will continue to significantly influence" the Harpeth.

The analysis provided in the attachment to our comments from Aquaeter (attachment 1) come to the same conclusion based on TMDL pollutant load calculations for oxygen demand. Using the TMDL equation that requires a margin of safety, incorporating pollutant loading from nonpoint sources, and using the specific data derived from the EPA in its TMDL, the amount of pollutant load the Harpeth can assimilate at the point of Franklin's outfall is 130 lbs/day of BOD (biological oxygen demand.) EPA's TMDL in comparison is four times higher at 427 lbs/day. Aqueater's

work is based on existing conditions in the Harpeth, whereas the EPA's TMDL made a significant assumption that the river in the summer would be above state standard of 5 mg/l. (The TMDL used 6 mg/l). With existing conditions, that include a 300 lb/day pollutant load from the Egyptian Lacquer chemical input from contaminated groundwater, 130 lbs/day is all there is in the Harpeth for the existing three sewer plants. This is significantly less than the proposed permits would allow.

Based on the field data and analyses summarized above, the draft permits appear to violate the Clean Water Act and the TN Water Quality Control Act by not setting permit limits so that water quality standards are met in the receiving stream--the Harpeth (see citations in TCWN comments). In addition, permits can not be authorized when "conditions of the permit do not provide for compliance with the applicable requirements of the CWA or regulations promulgated under CWA" (40 CFR Part D section 122.4 (a) and (d) and TWQCA 1200-4-5-.04(f)).

HRWA applauds the department in working on a watershed basis in these permit renewals. For the Harpeth river, this is the first time the 3 sewage treatment plants in Williamson County will have their permits synchronized for renewal. This enables TDEC for the first time to have all the permit holders, sister agencies, private sector experts, non-profit organizations, and the public focusing on establishing a solution and/or a process for finding a solution that the permits can drive that will result in the Harpeth meeting the state dissolved oxygen water quality standard in the near future.

A key to this will be Franklin's work on its new Integrated Water Resources Plan (IWRP) which will be integrating stormwater runoff, effluent discharge, effluent reuse, and water withdrawal for drinking water. The city of Franklin has also set goals in its sustainability plan for a reduction in the flow of treated effluent into the Harpeth during the summer low flow season. Williamson County has taken a lead role in addressing failing septic systems in neighborhoods around Lynwood STP. Both this sewer plant and Franklin will be receiving the sewage from over 400 currently septic served homes that will reduce the nutrient enrichment into Lynwood Creek that is also listed on the 303(d) list.

Comments Applicable to all three proposed permits:

1. Based on current conditions in the Harpeth, less effluent discharge in volume and in concentration of pollutants needs to be instituted for the low-flow summer season what is in the proposed permits. A waste load allocation and TMDL needs to be redone for the Harpeth. This can be put in motion as part of Franklin's insightful IWRP initiative. Also, Franklin should not shoulder all the work and cost for developing a WLA for the Harpeth all by itself both in terms of analysis and monitoring. Though, clearly Franklin will take the lead and will likely become the regional sewer system since it has a highly functioning STP that can meet tight effluent limits cost effectively and has already put integrated water management schemes into play, such as effluent reuse.

2. Aquaeter's comments offer an interim WLA for which to finalize the proposed permits for their short term period to the end of November 2011 that would apply for the summer, low-flow season. Establishing a waste load for the Harpeth in the vicinity of the discharges forms the foundation of a watershed based permit. Franklin can currently meet a 130 lbs/day load allocation in the summer since its effluent CBOD5 is very clean at just under 2 mg/l. At a 6 MGD flow, which is what the facility currently produces, and its current BOD5, the Franklin STP could meet this pollutant load. But, it would mean no discharge in the summer for Lynwood and Cartwright Creek (which wasn't even factored into the EPA TMDL.) Franklin in the summer season has been sending 3 -4 MGD of its effluent to irrigation reuse which does not get discharged into the Harpeth. With Franklin's effluent reuse that is already in place, there is some pollutant load that can be allocated to the two other sewer plants in the summer for the short term duration of these permits.

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12. The neighborhood in which Lynwood sits has complained again about odor. What can the department do with regard to the proposed permit to address this problem? The Cottonwood development layout that this facility was originally built for did not provide any buffering space for the facility.

13. Cartwright Creek has a significant I/I problem that the department recognizes in the draft permit (page R2). This significant increase in rain and groundwater into the facility is compromising the treatment according to the draft permit. The proposed permit does not have specifics as to how the utility will address this which needs to be done. This issue should be part of the IWRP so that these costs are incorporated in alternatives analysis that the project will be developing.

This permit renewal is really the beginning of developing a comprehensive plan for the mainstem of the Harpeth River so that it meets water quality standards during the summer low flow season. HRWA has been playing a significant role in collaborating with various state and federal agencies, working with the sewage treatment plant permittees, and brining in private outside TMDL experts to help contribute to creating the

framework for a cost effective plan for sewage management for the large growth area of the Harpeth River watershed so that the Harpeth will meet water quality standards as soon as possible. HRWA will be part of the stakeholder group of the IWRP that has its first meeting December 17.

HRWA would like to convene a gathering of all the permit holders, their consultants, other agency experts, TDEC, and any other interested parties to host a presentation and discussion of all the dissolved oxygen data. HRWA will offer this as part of the something we can bring to the IWRP effort. Please do not hesitate to contact me with any questions on these comments and I look forward to working with all the stakeholders.

Sincerely,

Dorie Bolze

Dorie Bolze
Executive Director
(615) 790-9767 ext. 101
(615) 479-0181 (c)

Cc: Paul Sloan, Deputy Director, TDEC
Paul Davis, Director, Water Pollution Control, TDEC
Vojin Janjic, Permit Section, Water Pollution Control, TDEC
Saya Qualls, TDEC
Mark Hilty, City of Franklin director of Water and Sewer
Tyler Ring, president, Lynwood Utility District
Bruce Myers, regional manager, Cartwright Creek LLC
Dave McKinney and staff, TWRA
Steve Alexander, US Fish and Wildlife Service, Cookeville
Rogers Anderson, Williamson County mayor
John Schroer, city of Franklin mayor
Bill Melville, EPA
Tom McGill, EPA
Mark Nuhfer, EPA

Attachments:

Below is a list of the attachments and a brief description of their relevance. Some are on the HRWA web site (under Library/Scientific Studies), so their location is supplied so they can be printed out for the file. Most of these documents you and others in the department have received already. I will mail you a printed set as well. Please contact HRWA for copies of any of these attachments.

1. **Comments on the Harpeth River Watershed NDPES Permits,** by Aquaeter to Harpeth River Watershed Association, Nov. 25, 2009

This memo includes calculations of the waste load allocation based on current river conditions that can be established now to apply for all 3 permits for summer low-flow season discharges until a TMDL is redone.

2. **Dissolved Oxygen in the Harpeth River: August-September 2006. Final.** Harpeth River Watershed Association. Bolze, Cain, and McFadden. Feb. 2007.

http://www.harpethriver.org/library/library?id=55414

This report compiled Dissolved Oxygen data from various sources since the EPA's data for the TMDL in 2001 up to 2006. TDEC's diurnal monitoring data from 2002 and 2003 is in Appendix E. HRWA's first Dissolved Oxygen study from 2002 is Appendix F. The 2006 D.O. monitoring coordinated by HRWA and TDEC was comprised of 10 sampling sites, 3 of which were TDEC sites. Maps in the report help to locate all the sites along almost the entire mainstem from the headwaters to the take out point at the Harpeth River State Park. USGS data on flow during the monitoring is included as well.

3. **Dissolved Oxygen Study: June – July 2007. Final.** Harpeth River Watershed Association. By Cain and Bolze.

http://www.sitemason.com/files/bMJfB6/HRWA%20July%2007%20dissolved%20oxygen%20study%20final%20report.pdf

Eight sites were monitored in the segment of the Harpeth River through downtown Franklin to see if affects of dissolved oxygen could be captured from the chemically contaminated seeps into the Harpeth River and from seeps into Liberty Creek that flows into the Harpeth. The contaminated groundwater is from chemicals released by Egyptian Lacquer Manufacturing Company. The upmost site is above the lowhead dam , and the furthest downstream site is downstream of the Franklin STP outfall.

4. **Dissolved Oxygen in the Harpeth River: September 2007.** Harpeth River Watershed Association. By Cain and Bolze. (electronic file)

The report is complete but without a discussion section because the most recent version was corrupted. The file is a scan of a printed version. Figure 1 that displays all the site data is missing one site (#10 at RM 84.8), but the data from that site are in the report. Just like with the 2006 survey, TDEC placed diurnal monitoring probes at 3 of the sites. This year's survey was the most extensive in distance and in number of sites.

5. **Harpeth River Dissolved Oxygen Survey**: September 2008. Draft. (electronic file).

This file has all the data from this year's survey in an excel spreadsheet with a summary table. TDEC wasn't able to employ the monitoring probes this year since they were in use in another watershed for the state's five-year cycle. The sites this year begin at the site below the Franklin STP outfall and the furthest downstream is at the Highway 70 bridge in Cheatham County.

6. **Water Quality Analysis: Harpeth River Between Franklin and Kingston Springs, TN.** Aquaeter. By Corn and Corn. For Harpeth River Watershed Association. September 2006.

http://www.sitemason.com/files/faR5Vm/Water%20Quality%20Analysis.pdf

This analysis discusses key assumptions in the EPA's TMDL for low dissolved oxygen, has estimated percentages of river flows that are treated effluent, and has TDEC's diurnal D.O. data from 2002 and 2003. Key assumptions in the TMDL include that the river will be at 6 mg/l of D.O. before the first STP outfall.

7. **Dissolved Oxygen in the Harpeth River: Connecting Point Source, Nonpoint Source, and Water Withdrawals.** Presentation to the TN AWRA by Aquaeter and HRWA. By Corn, Corn, Bolze, and Davee. April 2008. Powerpoint. (electronic file)

The powerpoint has EPA's Dissolved Oxygen data chart from the TMDL from August 2000 (p. 12), river flow data from the 2006 HRWA Dissolved Oxygen survey, three charts from TDEC's diurnal monitoring from 2002 and 2003 with estimated ranges of effluent percentage (pgs 14-16), and a simple mass balance for the Harpeth river to derive the flow needed to assimilate the design capacity of the Franklin sewer plant. If the Harpeth river just upstream of the Franklin outfall is 6 mg/l, then 96 cfs of flow is needed to provide enough oxygen to assimilate the effluent at the design flow of 12 MGD and current effluent concentrations. On page 23 is Figure 18 from the EPA TMDL that indicates that the BOD concentration in Franklin's effluent needs to be 3 mg/l for a 12 MGD design flow to meet the river's D.O. standard of 5 mg/l. This is lower than the 4 mg/l recommended in the TMDL summary table.

8. **Two Memos via email by Dorene Bolze, Harpeth River Watershed Association, to EPA, USFWS, TWRA, USGS, Aquaeter, and others, on findings from Dissolved Oxygen surveys.** March 08, 2007 re 2006 Dissolved Oxygen study and July 19, 2007 re June 2007 Dissolved Oxygen study in Franklin area. (electronic file)

The memos provide a summary of results that found low dissolved oxygen levels in violation of state water quality standards upstream and downstream of the various sewage treatment plant outfalls. Memos point to analysis of percent of river flow that is treated effluent during the monitoring period. Also discussed are assumptions in the EPA's TMDL for low dissolved oxygen and D.O. drop tied to the seeps of chemicals in the groundwater from Egyptian Lacquer.

Attachment 1

AquAeTer

MEMORANDUM

TO: **Ms. Dorie Bolze, Harpeth River Watershed Agency**
CC:
FROM: Mike Corn, P.E. (TN) and John Michael Corn, P.E. (TN)
DATE: 11/25/2009
JOB NO.:
RE: **Comments on the Harpeth River Watershed NPDES Permits**

Ms. Bolze:

We have the following comments concerning the three permits out for public comment for the Harpeth River. Specifically, these NPDES Permits are for the following facilities:

1. City of Franklin STP, NPDES # TN0028827:
2. Lynnwood Utility Corp. STP, NPDES Permit # TN0028827; and
3. Cartwright Creek, LLC, NPDES Permit # TN0027278.

1. Franklin is planning on reusing their effluent for water supply (irrigation, car washes, golf courses, etc.). This eliminates Lynnwood's and Cartwright Creek's allocation since their allocation is dependent on effluent flow from Franklin. Deny reissuance of Lynnwood and Cartwright Creek's permits except for winter months. There is no allocation in the Harpeth River for these discharges without the full flow from the Franklin STP flow.
2. The USEPA TMDL for Franklin is based on 4 mg/L BOD_5 at 12 mgd. This represents a BOD_5 loading of 12 mgd * 4 mg/L * 8.34 = 400 lbs/day or 2,000 lbs/day of $CBOD_u$ (total oxygen demand to the River using the USEPA $CBOD_u/BOD_5$ ratio of 5.4:1). The USEPA model assumed a 6 mg/L background dissolved oxygen (DO) coming to the Franklin STP discharge point. Both TDEC and HRWA have monitored DO in the Harpeth River and have found that DO during low flow critical summertime conditions is around 3 mg/L or about ½ the DO concentration used by USEPA. Additionally, the volatile organic seeps entering the Harpeth River from Liberty Creek and directly into the Harpeth around the railroad track near Liberty Creek contributes around 250 to 300 lbs/day of oxygen demand to the River, which shows up in the low DO's in the Harpeth River coming to the Franklin STP.
3. The TMDL is the following:

   TMDL = WLA + LA + Safety Factor

   Where:

   WLA is point source discharges (Franklin POTW);
   LA = background loading which is around 250 to 300 lbs/day of $CBOD_u$;
   Safety Factor = based on unknown factors. In this case, a higher safety

factor would need to be used since the USEPA model was based on an arbitrary DO of 6 mg/L when actual measurements are about ½ this value. A 50% safety factor would be appropriate for this TMDL. The safety factors typically assigned to TMDLs can range from 10% to 50%. For this case the safety factor should be on the high side since USEPA used a background DO of 6 mg/L coming to Franklin POTW.

Therefore,

TMDL = WLA + LA + Safety Factor
WLA for Franklin = TMDL – LA – Safety Factor
WLA for Franklin = 2,000 lbs/day – 300 lbs/day – 1,000 lbs/day
WLA for Franklin = 700 lbs/day $CBOD_u$
WLA for Franklin = 700 lbs/day/5.4 = 130 lbs/day BOD_5.

WLA for Franklin = 130 lbs/day/(8.34*12 mgd) = 130 lbs/day/100.8
WLA for Franklin = 1.3 mg/L $CBOD_5$ for a flow of 12 mgd

Franklin's allocation should be 12 mgd * 1.3 mg/L * 8.34 = 130 lbs/day at a BOD_5 of 1.3 mg/L vs the proposed limit of 4 mg/L. Franklin is currently discharging about 6 mgd of effluent and the Franklin STP achieves an excellent BOD_5 discharge concentration of around 2 mg/L. The effluent $CBOD_5$ limit at 6 mgd is:

130 lbs/day/(6 mgd * 8.34) = 130/50 = 2.6 mg/L $CBOD_5$

4. The TMDL included the Franklin STP and Lynnwood Utility Corp. STP discharges, but did not include Cartwright Creek, LLC discharge. Therefore, any allocation given to Cartwright Creek must come from either Franklin or Lynnwood or be flow proportioned between the two. At present, there is no allocation for Cartwright Creek.
5. Since both Lynnwood and Cartwright Creek effluent limits are based on the 12 mgd flow coming from the Franklin STP and since there are documented DO standard violations downstream from all three of these discharge points, a reduction in allocation equivalent to the Franklin STP calculated allocation should be enforced for both Lynnwood and Cartwright Creek STPs. It is unclear if there is actually any allocation for either of these plants to discharge to the Harpeth River and the USEPA TMDL did not even include the Cartwright Creek discharge. The actual DO data from the Harpeth suggests that there is no allocation for these plants.

{In Archive} Re: TN0028827 Franklin STP

Vojin Janjic to: Connie Kagey 12/17/2009 11:34 AM

Cc: Mark Nuhfer, "Gary Davis", "Saya Qualls", "Wade Murphy"

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Gary Davis" <Gary.Davis@tn.gov>, "Saya Qualls" <Saya.Qualls@tn.gov>, "Wade Murphy" <Wade.Murphy@tn.gov>

History: This message has been forwarded.

Archive: This message is being viewed in an archive.

email not saved

I re-read the language in 40 CFR 122.45(d) this morning, and consulted with Saya. My opinion is that we gain nothing by imposing an artificially-derived chronic limit. If there was a chronic criterion, there would be no discussion.

Therefore, I think we're better off having a daily max only. The only difference it would make is to record 2 exceedances on a DMR if facility exceeds the daily maximum limit (as they would automatically exceed monthly average).

Thanks for your comments.

Stay warm.

Vojin

>>> <Kagey.Connie@epamail.epa.gov> 12/16/2009 2:23 PM >>>

Vojin - I discussed this with Marshall again - he had also been working with NC to get the appropriate limits established in permits (mon avg/max)

He suggested to meet the intent of 40 CFR 122.45(d), one could still establish a daily average limit (and suggested even using the acute value to establish this limit).

So we really would encourage the establishment of two limits for silver (even if they are both the same).

thanks,
Connie Kagey

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA, "Gary Davis"
<Gary.Davis@tn.gov>

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy"
<Wade.Murphy@tn.gov>

Date: 12/16/2009 12:46 PM

Subject: Re: TN0028827 Franklin STP

Connie:

Wade brought to my attention that we do not have a chronic criterion
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a
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receiving waterbody and I only had the comments previously made for
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We would like to review the changes before you send these out.
I would like to get copies of any comments received by the state from

CL XL error

Subsystem: TEXT

Error: InternalError 0x50

Operator: Text

Position: 3035

{In Archive} Re: TN0028827 Franklin STP
Wade Murphy
to:
Connie Kagey
12/17/2009 07:04 AM
Hide Details
From: "Wade Murphy" <Wade.Murphy@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA

email not saved

Archive: This message is being viewed in an archive.

Vojin, this is unacceptable rationale to me especially when we have Jill Davis scrutinizing the efficiency of our permit writing. Franklin has already commented on the daily maximum limits for copper and silver, so monthly average limits won't go unnoticed. It is not very efficient for us to be making something up and defending it on an EPA" we really encourage". We look bad putting stuff in permits only to take it out again. Our attorney's won't take something as arbitrary as made up limits to the board if we put a monthly average silver in and they appeal it. Ask Patrick Parker. Why waste our time? I'm sorry if I seem obstructive. I just don't' see this kind of comment from the EPA in our best interest or the in the interest of water quality even. Thanks for getting this much explanation out of her. It's telling. Wade

>>> <Kagey.Connie@epamail.epa.gov> 12/16/2009 2:23 PM >>>
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We would like to review the changes before you send these out.
I would like to get copies of any comments received by the state from either the permittee or third parties regarding these three permits, too.

I am planning on being in the office the rest of this week and up until
Thursday morning (Dec 24). I will be out of the office from Dec 24 (about 11:30) until Jan 4.

thanks again,
Connie Kagey

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA, "Gary Davis" <Gary.Davis@tn.gov>

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy" <Wade.Murphy@tn.gov>

Date: 12/15/2009 08:40 AM

Subject: Re: TN0028827 Franklin STP

Connie:

I can locate that correspondence if you need me to - but I do remember what you're talking about. Yes, I agree that both CMC and CCC have to be
protected, regardless on which one the RP calculation was performed. We'll modity the permit.

As far as the rationale for nutrient limits goes, we can add some language in the addendum.

Vojin

>>> <Kagey.Connie@epamail.epa.gov> 12/15/09 7:13 AM >>>
Vojin - I understand, but disagree, what Gary's is attempting to state for #2, (and in the past I had no concerns about it, but it was pointed
out to me that this positions to take is incorrect) - when a pollutant is shown to have reasonable potential to "cause or contribute" to a water quality excursion, and it is a continuous discharge, then both limits (in this case, although it is a POTW, and normally per 40 CFR 122.45(d) one should apply the monthly average and weekly average, it is
not practicable to apply a weekly average value and thus a daily maximum
value should be applied. Even if a parameter does not have a chronic and acute value (like silver), a limit should be applied for both (even
if is the same limit).

Vojin, I thought you and I had discussed this or sent emails about this
in the past, but I cannot find my emails.

Therefore, silver and copper should both have limitations set for monthly average and daily maximum.

One more question I forgot last week, for Cartwright, there is a compliance schedule for meeting nutrient limits - yet no rationale was presented. The rationale did imply that additional time may be granted
(page R
-6). It should be noted that the TMDL has been in place for some
time, and this permittee should not be granted any additional time (via
the permit) to come into compliance - either through plant upgrades and
other means (connection into Franklin, etc.).

Please respond, thank you,
Connie Kagey

From: "Gary Davis" <Gary.Davis@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Vojin Janjic" <Vojin.Janjic@tn.gov>, "Wade Murphy" <Wade.Murphy@tn.gov>

Date: 12/14/2009 02:00 PM

Subject: Re: TN0028827 Franklin STP

Connie:
We appreciate your review/comments and provide the following reply:

1. We agree selenium limits are needed and will be included. As shown on p. R-36, I had mistakenly translated the Se Form 2A info as 2.7/2.9 ug/L, instead of the correct 27/29 ug/ for the avg/max values. Pursuant to the reasonable potential results shown on p. R-36, we will include Outfall 001 effluent Se quarterly monitoring based on composite sample with monthly avg = 0.005 mg/L and a daily max = 0.019 mg/L.
2. As shown on p. R-37, the copper Form 2A values were 20/110 ug/L

(avg/max) and calc'd Outfall 001 discharge values of 46.70 ug/L (chronic) and 74.51 ug/L (acute). Since the max value exceeded the acute requirements, we included a daily max permit limit of 0.075 mg/L; however since the 20 ug/L avg. was well below the chronic value, no monthly average was included. The permittee's semi-annual reporting shows most copper results to be below detection, so monitoring and limiting daily in the effluent should be sufficient, provided more frequent sampling is completed. Rather than add a monthly average limit, we will increase the copper monitoring to monthly and require reporting of the monthly average in addition to the daily maximum, if the 110 ug/L is a valid result.

Likewise for silver we included a daily max limit (0.010 mg/L), based on the max 12 ug/L Form 2A value and the calc'd Outfall 001 effluent 9.91 ug/L (acute). We do not have a chronic silver water quality standard for determining reasonable potential, thus no reasonable potential to violate the standard. Therefore, no monthly avg was included in the permit (the Form 1A avg provided was 1 ug/L).

The permittee questioned the rationale for including copper and silver limits in the draft permit and requested that they be removed. We will request that the permittee provide the copper and silver results used for the permit renewal application. Maybe the maximum copper value (110 ug/L) is a typo in their permit renewal application. We will provide you the copper and silver results, and revisit the above copper and silver determinations with you via email.

We agree with your comment regarding adding the units for the permit's p. 2 also & will change table.

3. We agree that a more sensitive mercury analytical procedure should be specified in this new permit , and will include an additional note in Section 1.2.3.Test Procedures, that mercury testing must be completed using Method 245.7 or 1631E, unless otherwise authorized in writing from the division. However, given the fact that this new permit will expire on November 30, 2011 (and we will have some mercury data using the more sensitive method for the next permit renewal), we don't think the permit reopener clause for mercury reevaluation based on their semi-annual pretreatment program results is warranted at this time.

Thanks

Gary

>>> <Kagey.Connie@epamail.epa.gov> 12/10/2009 3:22 PM >>>

Gary/Vojin

I have several concerns with Franklin's draft permit that I wish to bring to your attention.

I am requesting that you make the necessary changes to the permit based on my comments.

Could you please let me know early next week if you agree to these changes.

(1) A selenium limit (both monthly average and daily maximum) should be applied since this is a continuous discharge.

Per the rationale (page R-36) the calculated instream water quality selenium value is 4.7 ug/l (chronic) and 29 ug/l (acute). The application shows (six samples) that the average daily discharge was 27 ug/l and the daily maximum discharge was 29 ug/l. Based on these values, it clearly shows there is reasonable potential to violate the water quality, thus the permit should contain limits for selenium.

(2) As per 40 CFR 122.45(d) since this is a continuous discharge, the total copper and total silver should contain monthly average limitations (even if the frequency is 2/year). To be protective of the receiving waterbody, the chronic values should be applied as monthly average (as TDEC normally applies WQ standards).

Also, units for copper and silver should be included in the permit (page 2).. Units are included on page 1 under daily maximum column, but you should also clarify this on page 2.

(3) The total mercury as analyzed by the applicant is not stringent enough to make a determination that there is no reasonable potential to cause or contribute to a water quality standard. The applicant reports less than 0.0002 mg/l. As indicated in a memorandum from HQ, a sufficiently sensitive method of detecting mercury should be used.
See this website:
http://www.epa.gov/npdes/pubs/mercurymemo_analyticalmethods.pdf

Since Mercury is monitored via the pretreatment program, please include the appropriate testing method that the permittee should use to obtain more reliable data.

A specific re-opener should be added that notes that the permit

will
be modified to include an appropriate Hg limit if data provided indicates that there is reasonable potential to exceed the standard.

Thank your for the inclusion of the appropriate limits for the TMDL (CBOD5, ammonia, and total nitrogen), the ultimate CBOD study, the continued instream monitoring, and the development of the Nutrient Management Plan.

Connie Kagey
(404) 562-9300

{In Archive} Re: TN0028827 Franklin STP

Vojin Janjic to: Connie Kagey, Gary Davis 12/16/2009 12:46 PM
Cc: Mark Nuhfer, "Wade Murphy"

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>
To: Connie Kagey/R4/USEPA/US@EPA, "Gary Davis" <Gary.Davis@tn.gov>
Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy" <Wade.Murphy@tn.gov>

History: This message has been replied to.
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chronic silver
water
quality standard for determining reasonable
potential, thus no
reasonable potential to violate the standard.
Therefore, no
monthly avg was included in the permit (the
Form 1A avg provided
was 1 ug/L).
The permittee questioned the rationale for
including copper and
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Maybe
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results, and revisit the above copper and
silver determinations
with you via email.
We agree with your comment regarding adding the
units for the
permit's p. 2 also & will change table.
3. We agree that a more sensitive mercury
analytical procedure
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note in Section 1.2.3.Test Procedures, that
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authorized in writing from the division.
However, given the
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next permit renewal), we don't think the permit
reopener
clause
for mercury reevaluation based on their
semi-annual pretreatment
program results is warranted at this time.
Thanks
Gary

>>> <Kagey.Connie@epamail.epa.gov> 12/10/2009 3:22 PM
>>>

Gary/Vojin

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Could you please let me know early next week if you
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continuous discharge,
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monthly average
limitations (even if the frequency is 2/year). To
be protective of
the receiving waterbody, the chronic values should
be applied as
monthly average (as TDEC normally applies WQ
standards).

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included in the permit
(page 2).. Units are included on page 1 under
daily maximum column,
but you should also clarify this on page 2.

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applicant is not
stringent
enough to make a determination that there is no
reasonable
potential
to cause or contribute to a water quality
standard. The applicant
reports less than 0.0002 mg/l. As indicated in a
memorandum from

HQ,
a sufficiently sensitive method of detecting mercury should be
used.
See this website:

http://www.epa.gov/npdes/pubs/mercurymemo_analyticalmethods.pdf

Since Mercury is monitored via the pretreatment program, please
include the appropriate testing method that the permittee should
use
to obtain more reliable data.

A specific re-opener should be added that notes that the permit
will
be modified to include an appropriate Hg limit if data provided
indicates that there is reasonable potential to exceed the
standard.

Thank your for the inclusion of the appropriate limits for the TMDL
(CBOD5, ammonia, and total nitrogen), the ultimate CBOD study, the
continued instream monitoring, and the development of the Nutrient
Management Plan.

Connie Kagey
(404) 562-9300

{In Archive} Re: TN0028827 Franklin STP
Vojin Janjic to: Connie Kagey 12/16/2009 11:42 PM
Cc: Mark Nuhfer, "Gary Davis", "Wade Murphy"

email not saved

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>
To: Connie Kagey/R4/USEPA/US@EPA
Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Gary Davis" <Gary.Davis@tn.gov>, "Wade Murphy" <Wade.Murphy@tn.gov>
Archive: This message is being viewed in an archive.

It is the words "unless impracticable" in that paragraph that are making
me scratch my head on this one.

Let me think about it some more, and I'll get back to you tomorrow.

>>> <Kagey.Connie@epamail.epa.gov> 12/16/2009 2:23 PM >>>
Vojin - I discussed this with Marshall again - he had also been
working
with NC to get the appropriate limits established in permits (mon
avg/max)

He suggested to meet the intent of 40 CFR 122.45(d), one could still
establish a daily average limit (and suggested even using the acute
value to establish this limit).

So we really would encourage the establishment of two limits for
silver
(even if they are both the same).

thanks,
Connie Kagey

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA, "Gary Davis"
<Gary.Davis@tn.gov>

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy"
<Wade.Murphy@tn.gov>

Date: 12/16/2009 12:46 PM

Subject: Re: TN0028827 Franklin STP

Connie:

Wade brought to my attention that we do not have a chronic criterion
for silver. In that case, we do not really have any basis to establish
a
monthly limit. Do you agree?

Vojin

>>> <Kagey.Connie@epamail.epa.gov> 12/16/2009 8:02 AM >>>
Vojin - thank you.

I reviewed the entire permit for Franklin. It appears from what you
and
Gary have indicated that Franklin should be corrected to our
satisfaction (of our previous comments). For Lynwood, and Cartwright
Utilities, the permits were reviewed for impairments of concern to the
receiving waterbody and I only had the comments previously made for
Cartwright.

We would like to review the changes before you send these out.
I would like to get copies of any comments received by the state from
either the permittee or third parties regarding these three permits,
too.

I am planning on being in the office the rest of this week and up
until
Thursday morning (Dec 24). I will be out of the office from Dec 24
(about 11:30) until Jan 4.

thanks again,
Connie Kagey

PCL XL error

Subsystem: TEXT

Error: InternalError 0x50

Operator: Text

Position: 2777

TN0028827

{In Archive} Re: TN0028827 Franklin STP

Connie Kagey to: Vojin Janjic, Gary Davis 12/16/2009 09:02 AM
Cc: Mark Nuhfer, "Wade Murphy"

email not saved

From: Connie Kagey/R4/USEPA/US
To: "Vojin Janjic" <Vojin.Janjic@tn.gov>, Gary Davis <Gary.Davis@tn.gov>
Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy" <Wade.Murphy@tn.gov>
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thanks again,
Connie Kagey

"Vojin Janjic" Connie: I can locate that correspondence if you ... 12/15/2009 08:40:47 AM

From: "Vojin Janjic" <Vojin.Janjic@tn.gov>
To: Connie Kagey/R4/USEPA/US@EPA, "Gary Davis" <Gary.Davis@tn.gov>
Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Wade Murphy" <Wade.Murphy@tn.gov>
Date: 12/15/2009 08:40 AM
Subject: Re: TN0028827 Franklin STP

Connie:

I can locate that correspondence if you need me to - but I do remember what you're talking about. Yes, I agree that both CMC and CCC have to be protected, regardless on which one the RP calculation was performed. We'll modity the permit.

As far as the rationale for nutrient limits goes, we can add some language in the addendum.

Vojin

>>> <Kagey.Connie@epamail.epa.gov> 12/15/09 7:13 AM >>>
Vojin - I understand, but disagree, what Gary's is attempting to state for #2, (and in the past I had no concerns about it, but it was pointed out to me that this positions to take is incorrect) - when a pollutant is shown to have reasonable potential to "cause or contribute" to a water quality excursion, and it is a continuous discharge, then both limits (in this case, although it is a POTW, and normally per 40 CFR 122.45(d) one should apply the monthly average and weekly average, it is not practicable to apply a weekly average value and thus a daily maximum

value should be applied. Even if a parameter does not have a chronic and acute value (like silver), a limit should be applied for both (even if is the same limit).

Vojin, I thought you and I had discussed this or sent emails about this in the past, but I cannot find my emails.

Therefore, silver and copper should both have limitations set for monthly average and daily maximum.

One more question I forgot last week, for Cartwright, there is a compliance schedule for meeting nutrient limits - yet no rationale was presented. The rationale did imply that additional time may be granted (page R-6). It should be noted that the TMDL has been in place for some time, and this permittee should not be granted any additional time (via the permit) to come into compliance - either through plant upgrades and other means (connection into Franklin, etc.).

Please respond, thank you,
Connie Kagey

From: "Gary Davis" <Gary.Davis@tn.gov>

To: Connie Kagey/R4/USEPA/US@EPA

Cc: Mark Nuhfer/R4/USEPA/US@EPA, "Vojin Janjic" <Vojin.Janjic@tn.gov>, "Wade Murphy" <Wade.Murphy@tn.gov>

Date: 12/14/2009 02:00 PM

Subject: Re: TN0028827 Franklin STP

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Likewise for silver we included a daily max limit (0.010 mg/L), based on the max 12 ug/L Form 2A value and the calc'd Outfall 001 effluent 9.91 ug/L (acute). We do not have a chronic silver water quality standard for determining reasonable potential, thus no reasonable potential to violate the standard. Therefore, no monthly avg was included in the permit (the Form 1A avg provided was 1 ug/L).
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Connie Kagey
(404) 562-9300

William Melville
09/23/04 05:15 PM

To: Thomas McGill/R4/USEPA/US@EPA
cc: Paul Gagliano/R4/USEPA/US@EPA
Subject: Re: 11/24/03 e-mail message from HRWA

Tom: We did not receive any additional comments from Ms. Bolze or anyone else we met with in December 2003. Bill Melville
Thomas McGill

Thomas McGill
09/23/2004 04:36 PM

To: William Melville/R4/USEPA/US@EPA
cc: Paul Gagliano/R4/USEPA/US@EPA
Subject: 11/24/03 e-mail message from HRWA

Bill,

You received an e-mail message from Dorie Bolze of the Harpeth River Watershed Association (HRWA) on 11/24/03 regarding "Letter regarding comments on Harpeth TMDL, and directions to HRWA office for lunch and meetins on Dec. 4th. In her message, Ms. Bolze states that the HRWA "would like to formally request an extension to the comment period to accommodate [the 12/4/03] meeting and time to provide written comment afterwards." It is my understanding that during this meeting you informed Ms. Bolze that although EPA had not formally extended the comment period beyond 11/30/03, we would consider any comments they submitted following the meeting. As you are aware, we did not receive any comments from Ms. Bolze (or from anyone else who attended the meeting) after the meeting.

Please confirm that I understand this correctly by responding to this e-mail. Thanks.

Tom

2.40 Recd 9/30/02

Eddy Woodard
Director

CITY OF FRANKLIN
WATER & WASTEWATER DEPT.

P.O. Box 487
Franklin, TN 37065-0487

Tom - FY1

September 27, 2002

Ms. Stephanie Fulton
U.S. EPA Region 4
Water Management Division
Standards, Monitoring & TMDL Branch
West SMT Section
61 Forsyth Street, SW
Atlanta, Georgia 30303

Subject: Harpeth River Watershed Modeling Effort

Dear Ms. Fulton:

Thank you for providing the City of Franklin with a copy of the Harpeth River Watershed Modeling Effort: A tool for TMDL Development dated July 31, 2002, and the Harpeth River Modeling Data Report dated December 2001. We appreciate the opportunity to provide comments on this study. The Harpeth River is an important element in the overall quality of life in Franklin, and our City is very interested in any program addressing water quality of the River.

Because of our responsibility to effectively manage water resources for residents and businesses in Franklin, our understanding of your work, and the implications it may have to our City, is critical. To assist us with our review, we have worked with the environmental engineering firm Camp Dresser & McKee (CDM) to review the modeling report. I have attached CDM's comments to this letter, and ask that these comments be considered as you continue to develop these tools, and that these comments be made part of the EPA's official record for this project.

Overall, it is evident that a lot of good work has gone into developing the models. But, as pointed out in the attached letter, we do not believe that these results would be sufficient to develop technically defensible TMDLs for the River. In particular, we do not believe that overall calibration of the models, the contributions of non-point sources to the headwaters of the river, and the overall importance of periphyton have been sufficiently addressed. Additionally it is evident that the low flow conditions of the river in the summer months are critical to the overall water quality, and the models used have limitations under these conditions. We understand that EPA and TDEC are committed to

meeting the schedules as ordered by the Court. However, we believe it is critical that the information used to develop the TMDLs is complete and accurate.

We welcome the opportunity to discuss these comments with you in more detail. If you have any questions, please feel free to contact me.

Sincerely,

Eddy Woodard
Director
City of Franklin Water and Wastewater Department

Enclosure

cc: Christopher A Provost, P.E. DEE, CDM
Jay Johnson, City of Franklin, Tennessee
David Parker, P.E., City of Franklin, Tennessee
Sherry Wang, TDEC
Paul Davis, TDEC
Saya Qualls, TDEC

CDM
3200 West End Avenue, Suite 500
Nashville, Tennessee 37203
tel: 615 783-1755
fax: 615 783-1756

September 27, 2002

Mr. Eddy Woodard
Water Management Director
City of Franklin
109 Third Avenue South
P.O. Box 487
Franklin, Tennessee 37065

Subject: Harpeth River Watershed Modeling Effort

Dear Mr. Woodard:

CDM appreciates the opportunity to conduct a review of the Harpeth River Watershed Modeling Effort: A tool for TMDL Development, July 31, 2002, and the Harpeth River Modeling Data Report, December 2001. Comments are presented in the following paragraphs. As you are well aware, the City's involvement in the Harpeth River Watershed TMDL process is critical in developing and implementing a successful and accurate TMDL that serves to improve water quality and the quality of life in the City.

It is CDM's understanding that the EPA and TDEC developed the above documents and water quality models to establish TMDLs for waters in the Harpeth River Watershed to address organic enrichment/dissolved oxygen impairment. The models utilized by the EPA include:

- *LSPC (Loading Simulation Program in C++)* to generate the hydrology and the land-based pollutant loads from the Harpeth River Watershed using 51 subareas,
- *CE-QUAL-RIV1* to simulate the time-varying river hydraulics from RM 88.1 to 32.4,
- *WASP* to simulate water quality in the Harpeth River given pollutant loads from LSPC and hydraulics from CE-QUAL-RIV1 from RM 88.1 to 32.4, and
- *QUAL2E* to simulate river hydraulics and water quality in the Harpeth River above RM 89.2.

The short period of time in which was spent in developing the models demonstrates an admirable effort on the part of the EPA and TDEC to achieve the December 31, 2002 TMDL deadline, however, specific concerns related to the modeling effort in general and to each of the models developed are presented below.

General Comments

1. There are several instances where best available information may have been overlooked. The hydrologic component of the LSPC model was developed from 1992 USGS landuse data. These data do not reflect the significant growth and changes in landuse in many portions of the Harpeth River Watershed since 1992, and will not enable the model to accurately simulate the current hydrologic loading of the tributaries.

2. FEMA Flood Insurance Study river cross section data and cross sections interpolated from the FEMA data were used for the CE-QUAL-RIV1 model. Digital elevation models have been developed by local governments throughout the watershed and should be considered for the development of the CE-QUAL-RIV1 component.

3. A general observation is made by the EPA that Franklin's wastewater treatment plant is a significant source of nutrients and BOD (page 12, Harpeth River Watershed Modeling Effort: A tool for TMDL Development). While the effluent discharged from the plant does represent a significant hydraulic input into the River, the effluent quality is very high, approaching the practical limit of technology for treatment. Data in the report are not sufficient to determine the relative contribution of nutrients and BOD from the Franklin WWTP compared to all other sources.

   It is important to note that as reported, "during the August 2000 study, the lowest levels of DO throughout the watershed were observed in the headwaters (i.e., RM114.6). The average DO values generally increased in the downstream direction. In addition, the highest BOD concentrations in the system during the August 2000 study as well as the April 2001 study were also observed at RM114.6" (page 12, Harpeth River Watershed Modeling Effort: A tool for TMDL Development). These observations at RM114.6 are well before the Franklin WWTP discharge. In fact the data show instream values for DO are higher downstream of the Franklin WWTP (Figures 4 and 5, Harpeth River Watershed Modeling Effort: A tool for TMDL Development).

   The report states that "based on the available data, the sources of nutrient loads appear to be fairly well distributed throughout the watershed" (page 12, Harpeth River Watershed Modeling Effort: A tool for TMDL Development). Given this, and the DO trends, it is evident that the Franklin WWTP is not the primary concern for Harpeth River water quality.

   The report also states that nitrogen appears to be the limiting nutrient during low flows, indicated by algal growth potential tests (page 12, Harpeth River Watershed Modeling Effort: A tool for TMDL Development). The conclusion appears to be based

on the high phosphorus to nitrogen ratios without understanding the specifics of the system including the high background levels of phosphorus, the relationship and interaction of nutrients and periphyton (dominant algal form), or the overall dynamics that lead to algal growth in this system. Nitrogen may be the limiting nutrient however it is inconclusive that it limits algal growth or that managing nitrogen is a feasible approach to improve water quality in the Harpeth River. Further evaluation of algae and nutrients in this system should be conducted to fully understand their relationship.

4. LSPC

More detailed information should be provided on model parameters and the calibration of the flow and water quality components. Though certain information of the flow calibration was presented, statistical comparisons for all years (1992 through 2001) and a total for the 10-year period should be provided to judge the overall accuracy of the flow calibration. Additionally, there is no supporting information presented on water quality to judge the calibration of the water quality component. It is unclear how the water quality components of the model are derived.

5. CE-QUAL-RIV1

Information on the extent that the input (flow) data was smoothed should be presented. A statistical comparison of the calibration for velocity, depth and time-of-travel should be presented. The graphical comparison of the simulation and the time-of-travel data appears to show a poor level of calibration.

6. WASP

Again a statistical comparison of the predicted water quality components and measured water quality components should be provided. The graphical comparison of the model to the 2000 and 2001 field data appears to be poor in many cases, especially to dissolved oxygen, an important component of this effort. It appears that no information or field measurements were collected on the periphyton, a key source and sink of dissolved oxygen in the river. Field mapping and density measurements should have be done to accurately understand and simulate periphyton with respect to the production of dissolved oxygen (photosynthesis) and uptake of dissolved oxygen (respiration). Based on the lack of macrophytes documented in the study, it is evident that periphyton are much more critical to the overall system.

7. QUAL2E

QUAL2E was selected for use in the upstream segment (above RM 89.2) because of stability problems using CE-QUAL and WASP in extremely low flow channels.

Though QUAL2E can accurately simulate the hydraulics and provides stability for low flow channels, the model cannot simulate attached algae (periphyton), which is a key component in the upstream segment of the river. This is a critical limitation of the model and its application, particularly when periphyton is the dominant algae form. Additionally, as part of the calibration, the CBOD load was adjusted from LSPC for input into QUAL2E (as flow was for CE-QUAL-RIV1). The adjustments to the LSPC flow and water quality simulations appear arbitrary and should be re-examined by EPA and TDEC. Also, employing constant velocity and depth for the model for calibration is unusual. Values should be developed for other low flow conditions to be simulated. The constant reaeration rate of 2.5 day^{-1} should be refined to have reach specific values.

It appears that the EPA and TDEC took a traditional approach used to model relatively large streams and applied the methodology to the Harpeth River. Though these practices have been fundamentally successful in larger waterbodies, it seems that the methods may not produce the accurate results when applied to smaller low flow streams.

To accurately model the hydraulics of the Harpeth River, water quality components were sacrificed, indicating that modeling may not provide the results needed to accurately evaluate water quality in the Harpeth River. To accurately develop a TMDL for the Harpeth River Watershed, the changes to the watershed need to be evaluated including a thorough understanding of how low flows alone have affected water quality. Based on these comments, CDM recommends that the Harpeth River Watershed Modeling Effort: A tool for TMDL Development, be further evaluated and developed prior to it's use as a tool for accurate TMDL development.

Please contact me at your convenience if you have any questions regarding this, or any other matter.

Very truly yours,

CAMP DRESSER & McKEE INC.

Christopher A. Provost, P.E. DEE
Associate

cc: Mark S. Hilty, CDM
Jay Johnson, City of Franklin, Tennessee
David Parker, City of Franklin, Tennessee

HARPETH RIVER WATERSHED ASSOCIATION

June 4, 2002

Dr. Sherry Wang
TDEC
7th Floor, L & C Annex
401 Church Street
Nashville, TN 37243

Tom McGill and Stephanie Fulton
EPA, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303

Dear Sherry Wang, Tom McGill, and Stephanie Fulton,

At the recent AWRA conference held at Montgomery State Park, Tom McGill, Stephanie Fulton, Mike Corn of Aquaeter, Dr. Dave Wilson of Brown Caldwell who coordinates the Harpeth River volunteer sediment study, and I met afterwards to continue to discuss the TMDL modeling work on nutrient enrichment/DO for the Harpeth. We were interested in discussing how EPA was going to approach the TMDL model, some points regarding the EPA field data gathered in 2000 and 2001, and ways that the HRWA could work with EPA on the design of the TMDL model.

After that meeting, Mike Corn reviewed the draft EPA field data that Tom and Mark Koenig provided to us in January. Attached are Mike Corn's comments. We wish to provide them to you so that they may be of use to TDEC and EPA in guiding the model preparation for the TMDL.

In essence, Mike Corn's comments raise the concern that the data EPA gathered is not sufficient as of yet to calibrate the WASP model for the Harpeth. Based on the review, there are serious reservations that a model can be developed that can be used to accurately project nutrient allocations. This is important since during low flow conditions in the summer the largest source of nutrients to the river is the Franklin sewage treatment plant. In addition, two smaller sewage processing plants discharge into the Harpeth not far downstream. All three point sources will be affected by the TMDL allocation. During rain events, significant non-point sources of nutrients are contributors as well.

One of many important issues for the model is to somewhat accurately describe the role of algae in the system. The EPA field data to date only includes chlorophyll a so the model will underpredict the effect of algae on the DO. We believe that it is

P.O. Box 1127 ■ Franklin, Tennessee 37065 ■ Phone: 615-790-9767 ■ Facsimile: 615-790-9767 ■ www.harpethriver.org

important to collect other chlorophyll data to capture the role of both suspended and attached algae in the system. In addition, the BOD data were not collected to capture in stream decay rates. Without these rates, the model can not be calibrated to the Harpeth. Mike Corn's comments that are attached provide more detail.

As we explored with you in April, the HRWA is very willing to work with the EPA to gather more field data this summer season so that the TMDL model can be calibrated. Mike Corn of Aquaeter and other members of our Science and Policy committee with appropriate expertise and qualifications can design and/or conduct the studies. Because the summer field season is coming up, we would like to hold a conference call or meet at the EPA offices to discuss how we can work with the EPA and TDEC to gather important field data for the TMDL model and identify the sources of funds to do this.

As with the sediment TMDL, the HRWA views the opportunity to work with TDEC and the EPA on TMDLs as an important component to developing effective watershed restoration and management approaches. We believe that working on the nutrient enrichment/DO and the sediment TMDLs in the Harpeth would also provide approaches that can be used in other watersheds with similar ecoregional characteristics in Tennessee.

Please don't hesitate to contact me with dates that would work for you to discuss the attached comments and how to proceed with a data collection project for this summer on the Harpeth.

Sincerely,

Dorene Bolze
Executive Director
Dorie@DorieBolze.com
615-591-9095

Cc via email:

Paul Davis, TDEC
Saya Qualls, TDEC
Jim Greenfield, EPA
Bill Melville, EPA
Jay Johnson, city of Franklin

HARPETH RIVER
WATERSHED ASSOCIATION

SPECIFIC COMMENTS ON THE USEPA HARPETH RIVER MODELING DATA REPORT DECEMBER 2001

Prepared by
Mike Corn, President, Aquaeter, Brentwood, TN
May 2002

1. Time-series BOD tests were not done in accordance with standard published protocols. The standard approach is to do duplicate samples for each station for a period of 90 days. It is unclear why USEPA did not follow standard procedures on this important test procedure.

2. It was also not clear how USEPA set the time-series BOD bottles up in the field. It is important that the samples were not iced before the time-series bottles were set-up. The accepted protocol is to basically set-up the BOD bottles (typically 2-L BOD bottles for time-series tests) at the time of collection or soon afterwards without abruptly changing the temperature of the sample. If the samples were iced, then the test results are questionable.

3. The standard procedure calls for a DO measurement at time = ½ day to determine algal respiration and/or any immediate oxygen demand. Although this does not appear to have occurred, it would be invisible if the samples were iced and the time-series tests were not set-up within a short time from sample collection (i.e., if the samples were iced, sent to the laboratory and then set-up 24 hrs later).

4. The BOD samples taken in the downstream reaches of the Harpeth River after the wastewater treatment facilities had calculated lower $CBOD_u$'s then the upstream reaches. It was also noted that there appeared to be substantial inhibition and fluctuation in data quality in these downstream reaches with concentrations of both DO and nitrogen series varying up and down over the 120 day test series. It is unlikely that these data are of sufficient quality to be used in any modeling effort (See specifically HRM 62.4).

5. It appears that almost all samples were nitrifying from the time they were set-up in the bottle. It is also interesting that the CBOD curves apparently follow a second-order relationship, which is typical for most streams. The first-stage CBOD apparently occurred within the first 2 days with the second-stage CBOD occurring around 5 to 6 days.

6. Since the BOD time-series samples were not obtained sequentially with time of travel, there are no $CBOD_u$ data from which to determine the stream $CBOD_u$ k_1 rate. The bottle rates are not appropriate for the uptake rate in the River itself. This is a very fundamental point in modeling and this is a serious and fatal flaw in this dataset.

7. Likewise, it does not appear that the dataset included data with time of travel for TKN and ammonia-nitrogen. Again, there cannot be a calibration of this stream without knowing the instream decay rates for these parameters. The only way to calculate these rates for organic nitrogen decay and for ammnonia-nitrogen decay is through tracking the same water slug (i.e., with dye time of travel) and collecting simultaneously organic nitrogen and ammonia nitrogen samples along with the BOD time-series samples. There is no other way to determine stream decay rates.

8. Since this is a eutrophication model, nitrogen removal in the stream is fundamental to modeling the DO impacts from algal productivity and respiration. USEPA does not have the data to accurately predict this in the dataset that they have collected. Again this is a fatal flaw in the dataset and defeats the purpose of the modeling exercise, i.e., eutrophication.

9. USEPA collected chlorophyll a, but not total chlorophyll (a, b and c). Additionally, no algae identification was attempted nor algae abundance. Many of us in the stream allocation monitoring and modeling arena have found that algae can play a very important role in the DO balance in the stream. It appears from the nitrogen data that were collected that the Harpeth is nitrogen limited (TKN's on the order of 0.5 mg/L or less). With the dataset collected by USEPA and based on recent stream data collection efforts we have conducted, chlorophyll a is at best a gross estimate from which to model algal effects on DO in the River.

10. No attached algae impacts on the DO in the River were made. This may also be a critical component of the DO balance and eutrophication analysis that needs to be established for this stream.

11. Reaeration measurements were made using a stable krypton tracer technique. On a similar river system where a radiotracer reaeration test and stable krypton tracer reaeration test were made on similar reaches with low reaeration rates, the stable krypton reaeration tracer test resulted in reaeration test results that were about twice the accepted radiotracer reaeration test results. Granted this is still better than the wide range of results using

reaeration formulas without data, it still means that the algal analysis may be biased low due to the reaeration rate being higher than actual. This will again potentially cause the eutrophication analysis to be less than accurate.

12. The USEPA has selected the WASP model for modeling the Harpeth River. This model is very data-intensive and is a one-time simulation. That is, the simulation is good for the dynamic event that is modeled, but it is very unlikely that the same dynamic conditions will occur again. Although this detail will be lost in our overall ability to predict for this system, it would be prudent to begin with a steady-state model, such as, QUAL2e, that will allow validation under pseudo steady-state conditions that typically occur on this river system. The WASP model could then be built from the QUAL2e dataset, including properly collected and calibrated deoxygenation rates, reaeration rates and algal productivity determinations. WASP could then be used to refine some of the dynamic conditions that occur on the River including stormwater flows that potentially have a big impact on nutrient loadings to the River. The original calibration of the WASP model that we performed for the USEPA, Athens used this exact procedure and it laid a strong foundation for this model use.

13. USEPA collected a good diurnal dataset from which to determine the diurnal DO cycle. These data were not collected simultaneously with a dataset for DO, water temperature, $CBOD_u$, organic nitrogen, ammonia nitrogen, total and dissolved phosphorous and total chlorophyll collected with dye time of travel, and it will be difficult to tie the diurnal data in with true impacts from the physical/chemical data (not) collected on the River.

14. The dataset collected by USEPA is a good baseline set of data, but it is not the dataset necessary to calibrate either QUAL2e or WASP. The data will require the same interpretative skills that have been used in the current TDEC water quality model for the River. It is unlikely that a model can be constructed from this dataset that can be effectively used to make prudent decisions on the Harpeth River Basin and its longterm health.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

July 19, 2002

Ms. Dorene Bolze, Executive Director
Harpeth River Watershed Association
P.O. Box 1127
Franklin, Tennessee 37065

Dear Ms. Bolze:

Thank you for your June 4, 2002 letter regarding the Total Maximum Daily Load (TMDL) modeling work associated with the organic enrichment/dissolved oxygen impairment of the Harpeth River watershed. EPA Region 4 consulted with Dr. Sherry Wang of the Tennessee Department of Environment and Conservation (TDEC) in preparing this response to your letter. EPA and TDEC appreciate your continued concern and interest in this watershed.

As I discussed with you in Burns, Tennessee on April 5, EPA Region 4 and TDEC believe the dataset available to develop a TMDL for the Harpeth River system is adequate. The available data has enabled EPA to calibrate the hydrologic processes of a watershed model representing the Harpeth River basin (i.e., LSPC) and the hydraulic and hydrodynamic processes of a riverine model (i.e., CE-QUAL-RIV1) representing a 55-mile segment of the mainstem of the Harpeth River. The available data was also used to parameterize: 1) the organic loading characteristics of the watershed model; 2) the eutrophication/dissolved oxygen processes using the model WASP, which is linked with the hydrodynamic model; and 3) the water quality processes of the upper Harpeth River watershed using the steady-state dissolved oxygen model, QUAL2E.

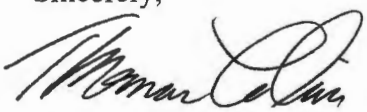
EPA is currently in the process of calibrating the WASP model for the Harpeth River. As is the case for the calibration of any model developed by EPA or TDEC, we would prefer to have more available data to improve our confidence in the model's ability to accurately predict the physical, chemical, and biological processes of the Harpeth River. However, EPA and TDEC have expended a significant amount of resources on the Harpeth River modeling project, especially considering the resource requirements associated with the hundreds of TMDLs that need to be developed throughout the State of Tennessee within the next few years. The Harpeth River data collection effort was designed and conducted by EPA's well-experienced and nationally-respected engineers and scientists with the Region's Science & Ecosystem Support Division. In addition, please be mindful that the field studies were designed with the full consideration of input provided by one of the technical consultants used by the Harpeth River Watershed Association.

EPA is working diligently to meet a Settlement Agreement requirement to complete a water quality model for the Harpeth River by July 31, 2002. The completed model will actually be comprised of the four models described in the second paragraph of this letter. TDEC intends to use these models to propose TMDLs for the impaired waters of the Harpeth River watershed by December 31, 2002.

Before the TMDL is proposed, however, EPA and TDEC will invite stakeholder input concerning the modeling effort. EPA Region 4 intends to share the completed models with all parties who have expressed interest in the Harpeth River TMDL effort, including the Harpeth River Watershed Association, by July 31. The calibration of the WASP model is a process that we anticipate will continue beyond July 31, and we will welcome input from you or any other interested party that has comments concerning this or any other aspects of the modeling effort. EPA and TDEC will consider any information or comments provided by you and any other stakeholder as part of the TMDL process.

EPA and TDEC appreciate the suggestion made by the Harpeth River Watershed Association to collect more data and information to improve the TMDL effort. After a TMDL is established for the impaired waters in the Harpeth River watershed, the TMDL will be revisited through TDEC's Watershed Management Planning process. Please note that TMDLs can always be refined in the future as new data and information becomes available. Although we are not in a position to commit to providing any funds for additional data collection in the Harpeth River, we would be happy to discuss any future data collection efforts with you. Feel free to contact me at 404-562-9243 if you have any questions or wish to discuss any of these issues.

Sincerely,



Thomas McGill, P.E.
TMDL Modeling & Support Section
Water Management Division

cc: Dr. Sherry Wang, TDEC
Mr. Paul Davis, TDEC
Ms. Saya Qualls, TDEC
Ms. Stephanie Fulton, EPA Region 4
Mr. Jim Greenfield, EPA Region 4
Mr. Bill Melville, EPA Region 4
Mr. Jay Johnson, City of Franklin

HARPETH RIVER
WATERSHED ASSOCIATION

HARPETH RIVER MAIN STEM DISSOLVED OXYGEN STUDY

September 18, 2002
Report prepared by Dr. Dave Wilson

Introduction

Dissolved oxygen (dissolved O_2, a.k.a. DO) is essential for fish and benthic macroinvertebrates. Although the concentration of oxygen in the air is quite high, O_2 is not very soluble in water, as indicated in Table 1 (following page); at saturation under one atm of air the oxygen concentration in water at room temperature is about 8.2 mg/L (8.2 parts per million, ppm). This is sufficient to maintain aquatic life. The regulatory minimum permissible DO is 5.0 mg/L.

There are a number of factors that affect the DO concentration:

1. Efficiency of reaeration from the atmosphere. Efficiency of oxygen transport is high in shallow, turbulent streams; it is poor in deep, slow-moving or stagnant streams.

2. Temperature. The solubility of oxygen in water decreases with increasing temperature. For example, at 14°C the solubility of oxygen in pure water (no dissolved salts) is 10.30 mg/L, while at 30°C it is only 7.56 mg/L.

3. Presence of Biochemical (Biological) Oxygen Demand, BOD. BOD consists of organic material (food processing wastes, human and animal feces and urine, paper mill wastes, dead and decomposing algae and leaves, etc.) that can be used as food by stream bacteria naturally present in surface waters. As the bacteria feed upon the BOD, they consume oxygen. They also multiply. If there is sufficient BOD present, its metabolism by the stream bacteria will use up all of the dissolved oxygen in the water. At this point fish and most benthic macroinvertebrates die of suffocation—we have a fish kill.

4. Presence of plant nutrients and sunlight. If the water contains sufficient plant nutrients (principally nitrate and phosphate) and is exposed to a substantial

amount of sunlight, the algae in the water will grow very rapidly, perhaps to the point where a "bloom" results, making the water very turbid and greenish in color. During the day the algae use the sunlight, carbon dioxide, and water to photosynthesize, in the course of which they increase their biomass and also generate oxygen. This results in increasing DO concentrations during the daylight hours. At night, however, photosynthesis is not possible, the algae are metabolizing (a process that uses up oxygen), and DO concentrations go down. Streams that receive nitrates and phosphates from fertilizer runoff or other sources, and that are relatively unshaded from the sun are particularly prone to large day-to-night swings in DO concentration, with the minimum DO occurring just about at dawn and the maximum at about sunset. The effect is particularly large when the water is warm, so that biological processes are rapid, and days are long, so there is lots of light.

Table 1. Oxygen solubility in water at 1 atm (760 mm Hg) pressure of air

	Chlorinity, g/L		
Temperature °C	0.0	0.5	1.0
	Oxygen solubility, mg/L		
10	11.28	11.22	11.15
12	10.77	10.71	10.65
14	10.30	10.24	10.19
16	9.87	9.81	9.76
18	9.47	9.42	9.36
20	9.09	9.05	9.00
22	8.75	8.70	8.65
24	8.42	8.38	8.33
26	8.12	8.08	8.03
28	7.83	7.79	7.75
30	7.56	7.52	7.49
32	7.30	7.27	7.23
34	7.06	7.03	6.99
36	6.83	6.80	6.77
38	6.62	6.59	6.56
40	6.41	6.38	6.35

At barometric pressure P (mm Hg), the solubility S' is given from the corresponding value in the table, S, by

$$S' = S \cdot (P - p)/(760 - p)$$

where p is the pressure (mm Hg) of saturated water vapor pressure at the given temperature.

The Harpeth River exhibits characteristics that lead one to expect that it suffers from low DO concentrations during the latter part of the summer and early fall. It

receives plant nutrients from wastewater treatment plant effluents, runoff from lawns and golf courses, and runoff from agriculture and animal husbandry. Much of the river is relatively unshaded due to destruction of riparian vegetation. And there are frequent relatively deep, quiescent sections in which reaeration is inefficient, particularly during periods of low flow during the summer and early fall. Data obtained by TWRA had indicated that there was a problem.

The Harpeth River Watershed Association therefore decided to carry out a dissolved oxygen study on the Harpeth between Riverwalk Park in Franklin and the Highway 100 bridge in Bellevue. Members of the HRWA's Science and Policy Committee designed the study. The project design was based upon the lessons learned from a similar study in August 2001 using trained volunteers with hydrolabs or a Winkler method digital titrator kit at four sites.

Methods and sampling stations

A number of techniques for measuring DO were tried (various meters, Winkler drop count titration, Winkler syringe, and Winkler digital titrator); the Winkler digital titrator kit from the Hach Chemical Co. was selected on the basis of consistent precision of the results. Three of these kits were used in the study.

Sampling stations are located at the following sites (upstream to downstream):

1. Harpeth River at Riverwalk Park, 4th Ave N and Hillsboro Rd, upstream from the Franklin, TN sewage treatment plant (STP).
   35°55'45"N, 86°52'30"W

2. Harpeth River at Williamson County Park canoe dock, downstream from the Franklin STP.
   35°56'40"N, 86°52'15"W

3. Harpeth River at Highway 46 bridge, Old Hillsboro Rd.
   35°59'35"N, 86°53'58"W

4. Harpeth River at Moran Road bridge.
   36°01'01"N, 86°53'58"W

5. Harpeth River at Highway 100 bridge, Bellevue.
   36°03'15"N, 86°55'43"W

These are marked on the map of the Harpeth River watershed. (The map is not included in the electronic version of this report).

Early morning minimum DO values at the various stations, August 24, 2002

The following DO concentrations were observed at the five stations the morning of August 24, 2002:

Site	Time	DO, mg/L	
1. Harpeth River at Riverwalk Park	4-5 AM	3.76	
		4.14	
2. Harpeth R at Williamson Co. Park dock	4-5 AM	5.42	
		5.48	
		5.28	
3. Harpeth R at Highway 46 bridge	4:50 AM	4.30	T = 26.1°C
	5:15	4.28	
	5:35	4.28	
4. Harpeth R at Moran Rd bridge	5:40 AM	3.86	
	6:05	3.95	
	6:20	4.00	
5. Harpeth R at Highway 100 bridge	6:50 AM	4.37	T = 26.1°C
	7:13	4.24	

Effect of algal diurnal cycle

Sets of runs were made at Site 6 (Harpeth River at Highway 100) at dawn and late in the afternoon on August 26, 2001, and again on August 24, 2002. The results are as follows:

Date	Time	Dissolved oxygen concentration, mg/L	
August 26, 2001 morning	4:15 AM	5.26	
	4:45	5.22	
	5:15	5.04	
	5:45	5.00	
	6:15	5.20	(bubble in DO bottle)
	6:30	5.16	
	6:45	5.10	
	7:15	5.10	
	7:45	5.08	
	8:15	5.12	
	8:45	5.24	

	9:15 AM	5.10	
afternoon	5:15 PM	6.34	
	5:45	6.40	
	6:15 PM	6.40	
August 24, 2002	6:30 AM	4.12	T = 26.1°C
morning	6:50	4.37	
	7:13 AM	4.24	
afternoon	4:00 PM	6.95	T = 28.9°C
	4:30 PM	6.78	

In the 2001 sampling the diurnal variation in DO concentration was approximately 1.2 mg/L; in the 2002 sampling it was approximately 2.6 mg/L.

Sets of runs were made the afternoon of August 23, 2002 and in the early morning of August 24 at Sites 1 (Riverwalk Park) and 2 (Williamson County Park). The results are as follows:

Site	Time	DO (mg/L)
Site 1	1:20 – 2:00 PM, 8/23/02	6.8, 6.8
	4:00 – 5:00 AM, 8/24/02	3.76, 4.14
Site 2	2:15 – 3:00 PM, 8/23/02	6.7, 6.9
	4:00 – 5:00 AM, 8/24/02	5.42, 5.48, 5.28

Conclusions

Four of the five sites, including Site 1 (upstream from the Franklin STP) were in violation of the regulatory minimum DO standard of 5.0 mg/L the morning of August 24, 2002. The only site that is in compliance is Site 2, just downstream from the Franklin STP. Because of the rather limited data set at present, one can only tentatively draw the following conclusions:

1. The dissolved oxygen concentrations in the discharge from the Franklin STP appear to be sufficient that the DO levels of this discharge are not exacerbating the DO problem in this section of the Harpeth River.

2. The cause of the low oxygen levels is negatively affecting the river upstream from the Franklin STP, as indicated by the results for Site 1.

3. The rather large diurnal swing (2.6 mg/L) in DO concentrations observed at Site 5 suggests that algae are a major contributor to the problem. This, in turn, suggests

that the problems may be (1) nutrients—nitrates and phosphates, and (2) unshaded streams. The high temperature of the water and the low stream flow are certainly contributing factors.

Acknowledgements

This study was conducted under the auspices of the Harpeth River Watershed Association's Science and Policy Committee. The study was designed and carried out by Dr. Wilson, Professor Emeritus at Vanderbilt University; Dr. John Callighan, chemist, both as volunteer members of the committee; and John McFadden, HRWA Director for Science. This 2002 field study is based on the lessons learned from a similar study in 2001 with trained volunteers who were up at 5am to take measurements. We would like to thank these dedicated volunteers: Rick Lockwood, board member; Mike Walton, President of the Board; Dorene Bolze, Executive Director, and members Toni Peterson, Cooper Magli, and Dave Wilson.

The Harpeth River Watershed Association is very grateful to all the members of the Science and Policy Committee who represent a range of scientific and policy expertise that they donate on behalf of the mission to work together to protect and restore the ecological health of the Harpeth River and its watershed.

Global Environmental, LLC
Environmental Consulting

November 12, 2013

Ms. Dorie Bolze
Executive Director
Harpeth River Watershed Association
PO Box 1127
Franklin, TN 37065

Subject: Liberty Creek Flow and Oxygen Demand
ELMCO Solvent Release Response

Dear Dorie:

Global Environmental, LLC was retained to review available information to assess the groundwater flow rate and contaminant loading into Liberty Creek due to an ongoing release of solvents from the Egyptian Lacquer Manufacturing Company (ELMCO) in downtown Franklin. Even though the vast majority of investigations were completed almost five years ago, contaminants are still flowing into Liberty Creek. Those organic solvents create an oxygen demand in the groundwater, in Liberty Creek, and in the Harpeth River at the point of discharge along the stream banks.

Liberty Creek flows into the Harpeth River in downtown Franklin just upstream of the Franklin Road bridge crossing of the river. The ultimate biochemical oxygen demand ($CBOD_u$) associated with contaminant degradation is added to any pre-existing loading in the Harpeth River. Site maps from the latest reports prepared by others on the contaminant monitoring, that have been slightly adapted to provide location, are included as ***Attachments***.

Below are the calculations associated with converting groundwater concentrations of toluene, aquifer parameters for hydraulic conductivity, groundwater gradient (slope), and theoretical oxygen demand to estimate the $CBOD_u$ loading into Liberty Creek due to the on-going flow of contaminated groundwater into the creek.

GROUNDWATER DISCHARGE RATE USING DARCY'S EQUATION

Calculations for groundwater discharge used aquifer parameters that were generated by Triad Environmental Consultants (Triad), on behalf of ELMCO, during their contaminant investigations that were performed around 2007 / 2008. Global Environmental used those parameters in Darcy's Equation to estimate the groundwater discharge along the eastern stream bank of Liberty Creek. These estimates indicated that the theoretical groundwater discharge along Liberty Creek could range from approximately 31,000 gallons per day (0.048 $ft.^3/sec.$) to 245,000 gallons per day (0.397 $ft.^3/sec.$). Details of these calculations are given below:

PO Box 58302, Nashville, Tennessee 37205

Discharge (Q, gallons per day) = Hydraulic Conductivity (ft./sec.) x hydraulic gradient x cross sectional area of the aquifer. Aquifer parameters for this calculation were obtained from Triad (*Report of Additional Solvent Release Investigations*, March 25, 2008). The input calculation parameters were:

- **Hydraulic Conductivity**: 0.0048 ft./sec for well MW-1 (assumed for this calculation to be the "minimum"). The maximum value was assumed to be 0.0379 ft./sec. based upon published values typical in karst environments, according to Triad. Although Triad reported seven hydraulic conductivity field values in their report based upon actual slug tests of four (4) on-site monitoring wells, *none* of those tests were from wells screened across the highest conductive zone of the aquifer. The zone of highest conductivity is the weathered rock at the top or bedrock and along joints or "cutters" in the bedrock. In the absence of that data and for calculation purposes, use of the published value 0.0379 ft./sec. was meant to be a high-end estimate of the range.
- **Hydraulic Gradient** – 0.02 foot / foot was used.
- **Cross Sectional Area** – Triad assumed a 5-foot aquifer thickness and that the contamination plume extended 100 linear feet along the eastern stream bank of Liberty Creek. Triad described the aquifer nearest Liberty Creek to be weathered bedrock.

$CBOD_u$ LOADING USING THEORETICAL OXYGEN DEMAND

The $CBOD_u$ of toluene-contaminated groundwater that discharges into Liberty Creek was calculated. The most recent sampling result for toluene (114 mg/L) of the Liberty Creek Main Seep sampled collected by Triad on September 18, 2013 was used to estimate the $CBOD_u$. The estimated $CBOD_u$ associated with the discharge of dissolved-phase toluene into Liberty Creek was determined by calculating the following:

1. **Oxidation Stoichiometry to Calculate Theoretical Oxygen Demand**: stoichiometry equations were used to calculate the theoretical oxygen demand of toluene (calculations performed by Deborah Herron Miede, Ph.D., an environmental toxicologist, included as an ***Attachment***). The result was 3.12 mg/L of $CBOD_u$ is produced for every mg/L of toluene in the water. Assuming that 114 mg/L is representative of the groundwater discharge into Liberty Creek, the resulting $CBOD_u$ would be 356 mg/L, calculated as follows:

$$114 \text{ mg/L} \times 3.12 = 356 \text{ mg/L } CBOD_u$$

2. **$CBOD_u$ Loading into Liberty Creek**: theoretical oxygen demand of 356 mg/L of $CBOD_u$ of the Main Seep was assumed to be representative of the groundwater discharge along the entire 100-foot stream bank section of the plume estimated by Triad. Assuming the groundwater discharges calculated above by Global Environmental, the 356 mg/L $CBOD_u$ loading rate, and a standard conversion factor (8.34), the total $CBOD_u$ loading of contaminated groundwater into Liberty Creek was calculated as follows:

- ***Theoretical Minimum***: approximately 90 pounds $CBOD_u$ per day based upon the discharge rate of 31,000 gallons per day (0.031 million gallons per day) and 114 mg/L.
- ***Theoretical Maximum***: approximately 730 pounds $CBOD_u$ per day based upon the discharge rate of 245,000 gallons per day (0.245 million gallons per day) and 114 mg/L.

The actual $CBOD_u$ loading rate would be even higher because the above loading does not include acetone or numerous other organic chemicals that flow into Liberty Creek. (e.g., ethylbenzene, 1,2,4-trimethylbenzene, xylenes, etc.).

CONTAMINATED SOIL AND GROUNDWATER REMAINS

Although several phases of investigations have been implemented on the ELMCO property and to a much lesser degree, the nearby Daniels Drive neighborhood, significant amounts of contaminated soil and groundwater still remain in the presumed source area at ELMCO and off-site beneath the Daniels Drive residential neighborhood. This contamination continues even though source area remediation has been tried (and completed in August 2011) and an interceptor trench was constructed along Liberty Creek. There is evidence to support the presence of free-phase (i.e. pure chemical) acetone and toluene in the ELMCO source area – even though bio-stimulation activities were completed over two (2) years ago. Specifically, consider the following:

- The most recent toluene concentrations of 114 mg/L at the Main Seep and 200 mg/L in a source area well EV-10 collected on August 30, 2013 (AquAeTer, September 20, 2013 report) are well above the 5.4 mg/L concentration (1 percent of the solubility limit) that the US EPA uses to estimate if free-phase toluene is present in groundwater.
- The most recent concentration of acetone at well EV-8 on the ELMCO property collected on August 30, 2013 (AquAeTer, September 20, 2013 report) had 62,800 mg/L – a concentration that illustrates that 6.2% of that presumed "water" sample was in fact acetone.

The significant amount of toluene-contaminated groundwater can be expected to continue to contaminate Liberty Creek into the future, based on groundwater flow direction and velocity calculations determined by ELMCO's consultant, Triad. This contamination will continue to reduce dissolved oxygen / increase the $CBOD_u$ in Liberty Creek that flows into the Harpeth River for the foreseeable future.

Further, acetone-contaminated groundwater can be expected to affect the Harpeth River to the south of ELMCO. Historically, two different contaminant plumes and seep discharges have occurred. Toluene and other miscellaneous organic hydrocarbons have traditionally occurred in Liberty Creek. Acetone-contaminated groundwater traditionally flows southward to the Harpeth River and was reported for years in a seep sample along the bank of the Harpeth River. Following the May 2010 flood, the seep location is no longer present; however, no in-

depth stream bank assessment has apparently been performed to locate other replacement seeps that contain acetone. Given the significant amount of acetone contaminant mass present on ELMCO property, that source area acetone – and its effect on $CBOD_u$ - is expected to continue its migration into the Harpeth River.

Should you have any questions, please feel free to contact me at markquarles@comcast.net or 615-646-0969.

Sincerely,

Mark Quarles, P.G.

Attachments

Attachment 1
Oxidation Stoichiometry to Calculate Theoretical Oxygen Demand for Acetone and Toluene
By Deborah Herron Miede, Ph.D.

Liberty Creek Main Seep Concentrations

	Triad (9/13) – mg/L	Aquaeter (8/13) – mg/L
Acetone	<2.50	21.9 (estimated)
Toluene	114	121

Toluene:
$C_7H_8 + 9\ O_2 \rightarrow 7\ CO_2 + 4\ H_2O$
Oxygen demand:
9 mol O2/mol toluene X 32 g O2/mol O2 / 92.14 g toluene/mol toluene
= 3.12 g O2/g toluene
= 3.12 mg O2/mg toluene (TOD of toluene)
Acetone:
$C_3H_6O + 4\ O_2 \rightarrow 3\ CO_2 + 3\ H_2O$
4 mol O2/mol acetone X 32 g O2/mol O2 / 58.08 g acetone/mol acetone
=2.20 g O2/g acetone
= 2.20 mg O2/mg acetone (TOD of acetone)

CALCULATION OF THEORETICAL OXYGEN DEMAND AT MAIN SEEP:
TRIAD SAMPLING RESULTS
Acetone:
Below detection limits
Toluene:
114 mg toluene/L X 3.12 mg O2/ mg toluene
= 356 mg O2/L

TOTAL (acetone + toluene) = 0 + 356 mg O2/L = 356 mg O2/L

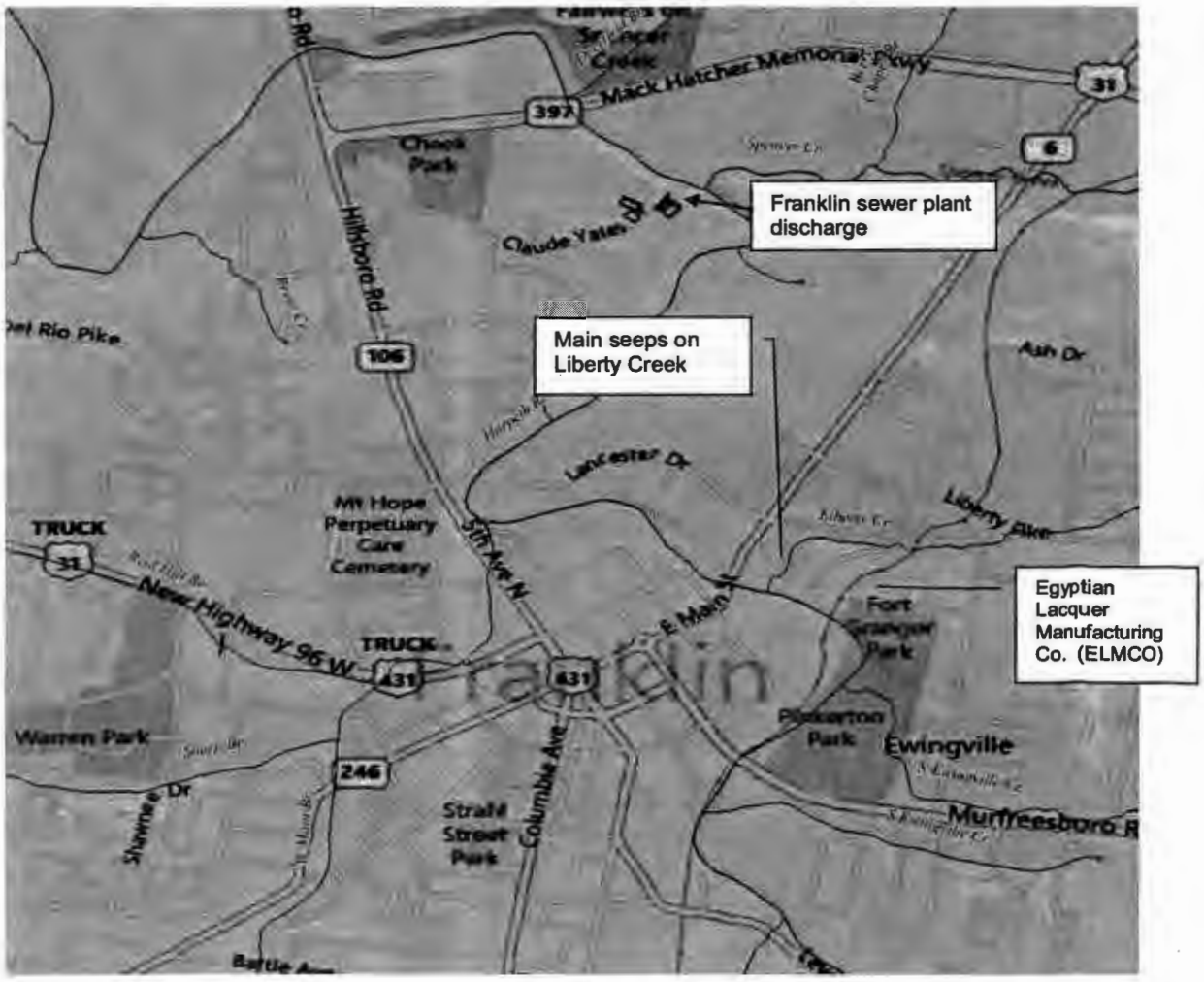
AQUAETER SAMPLING RESULTS
Acetone:
21.9 mg acetone/L X 2.20 mg O2/ mg acetone
= 48.2 mg O2/L
Toluene:
121 mg toluene/L X 3.12 mg/O2/ mg toluene
= 377 mg O2/L

TOTAL (acetone + toluene) = 48.2 mg O2/L + 356 mg O2/L = 404.2 mg O2/L

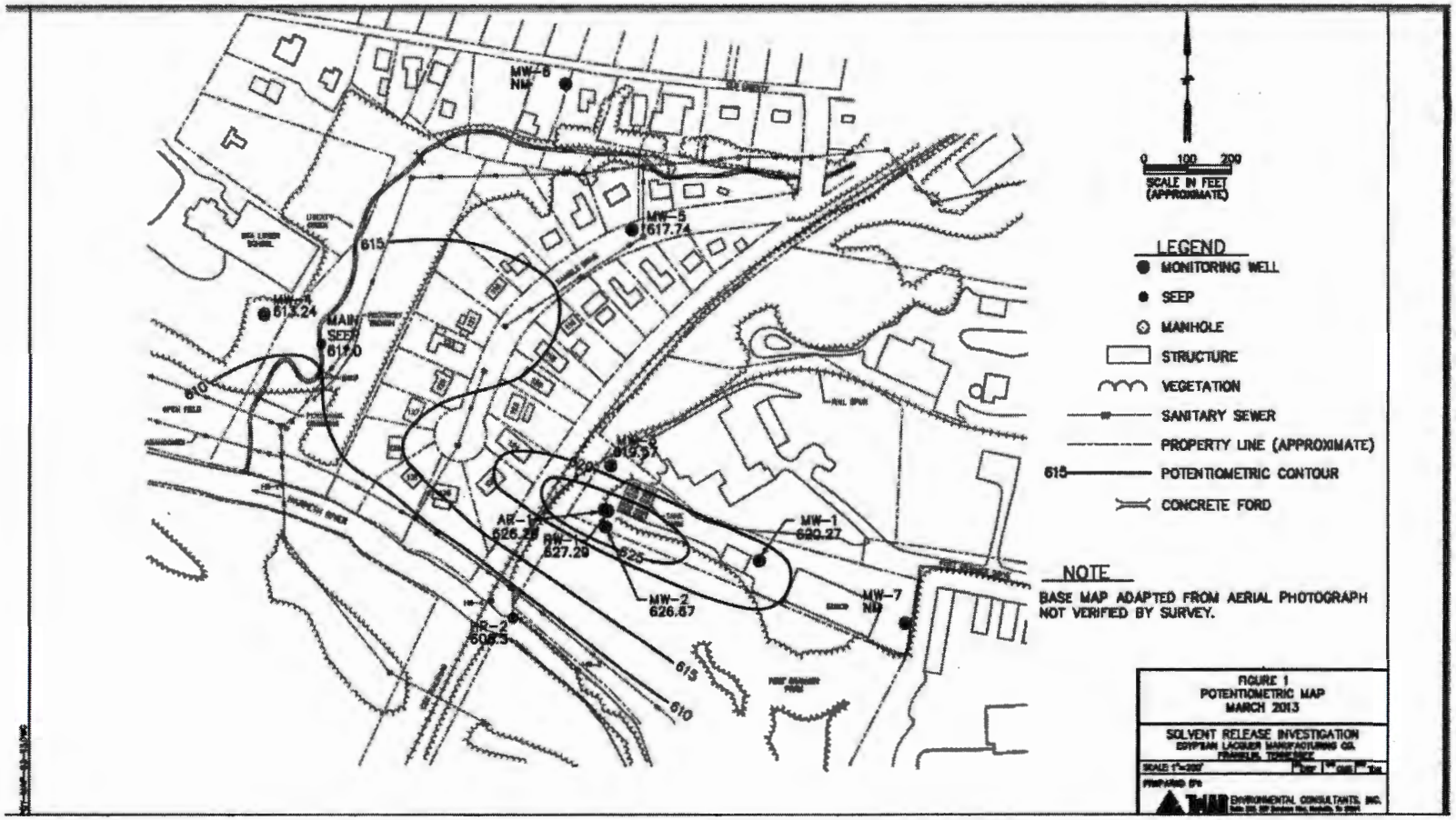
Reference: Mihelcic, JR, MT Auer, DW Hand, RE Honrath, JA Perlinger, NR Uran, MR Penn, Fundamentals of Environmental Engineering, pp335, John Wiley & Sons, 1999.

SITE MAPS

Liberty Creek is only 2.5 river miles upstream of the Franklin sewage treatment plant discharge.



Site Map adapted from AquAeTer, Sept. 30, 2013 report.



Potentiometric Map from Triad reports. This shows location of various monitoring locations, ELMCO, residences along Daniels Drive, Liberty Creek, and the Harpeth River in downtown Franklin.

December 1, 2009

Mr. Gary Davis
Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex
401 Church Street
Nashville, Tennessee 37243

Re: Draft NPDES permits:
Franklin STP, TN0028827: Lynwood Utilities STP, TN0029718:
Cartwright Creek LLC – Grassland STP, TN0027278

Dear Mr. Davis,

Thank you for accommodating our request in October to extend the comment period until December 1 to enable us to compile our materials and analyses to provide to the department on these proposed permits. Please incorporate all of the attachments provided with this summary into our comments for the record. Also, HRWA signs onto the comments provided by the Tennessee Clean Water Network as they have signed onto ours in order to provide the department with comprehensive input without duplicating effort. TCWN has included review of the three permits by Dr. Joann Burkholder, an aquatic ecologist, who is the director of the Center for Applied Aquatic Ecology at NC State University. HRWA has included an analysis and calculations of the pollution load the river can handle based on the TMDL principles and current field conditions from Mike Corn, President of Aquaeter, an environmental engineering firm with extensive experience in TMDLs and water quality.

In addition to these comments I would like to reiterate our request for a joint public hearing on the three proposed permits. Having worked with the department on prior permit renewals (Lynwood and Franklin) and the ARAP permit for a withdrawal regime for Franklin's drinking water plant, I would like to suggest that the joint public hearing be set in January after the public hearings on the triennial review of the water quality standards. In consideration of the holiday season as well, setting a public hearing for late January will enable more public attendance to learn and provide input.

These three sewage treatment plants (STP) discharge directly into the Harpeth River within a 17 mile stretch of one another in the upper third of the watershed. The receiving waters are impaired as a result of low dissolved oxygen levels, nutrients and phosphates according to TDEC's 2008 303(d) list. Franklin's STP, with a design flow of 12 MGD (million gallons a day), is the largest point source discharger in the entire 872 square mile watershed, and is classified as a major discharger. At this time, the facility is operating at about half that capacity. The other two STPs, though significantly smaller as minor dischargers, are not far downstream. The EPA completed a TMDL for Nutrient Enrichment/Low Dissolved Oxygen in 2004 that applied to the Harpeth from the headwaters down to the mainstem's confluence with the Little Harpeth at the Williamson County line.

Violations of the state's dissolved oxygen standard in the Harpeth occur during the summer when the river naturally has its low flow summer season. Data gathered by the EPA, TDEC, HRWA, and consultants in studies related to various permit issues on the Harpeth have documented low dissolved oxygen levels as far downstream as the Harpeth River State Park in Cheatham County. The Harpeth River is listed on the 303(d) for low dissolved oxygen all the way downstream to the confluence with the South Harpeth in Cheatham County. These violations are occurring in two Tier II sections of the Harpeth River: the state scenic river section in Davidson County, and the adjacent downstream section in Cheatham County adjacent to the number properties that comprise the Harpeth River State Park. The attachments include four different dissolved oxygen studies of the Harpeth River that HRWA has conducted since 2002 with various partners and supporters. The two most extensive in 2006 and 2007 were coordinated with TDEC field staff with the study in 2007 funded in part by the TN Wildlife Resources Agency.

A number of analyses have been done that have built on and relooked at key aspects of the EPA's TMDL(Attachments 6 and 7). In addition to the mainstem's dissolved oxygen studies, HRWA has funded analyses, completed an EPA grant with Franklin and Williamson County as partners, and received several state 319 stream restoration grant that have encompassed the following: watershed plans and stream restoration in the headwaters, bacterial surveys and efforts toward addressing failing septic in the headwaters, characterized the effluent domination of the river's flow in the summer downstream from Franklin, amount of industrial chemical oxygen demand just upstream from Franklin's discharge from contaminated groundwater seepage from Egyptian Lacquer, the effect on the river's assimilative capacity from water withdrawals, and the use of site level stormwater runoff tools to reduce stormwater runoff contributions from development.

A key finding from several years of summer dissolved oxygen monitoring is that the Harpeth River does not meet the state water quality D.O. standard upstream from the first permitted sewage treatment plant. Data gathered measured times when the river was below state standards upstream of each of these permitted discharge points. Based on analysis funded by HRWA, at times when the river's dissolved oxygen levels were significantly below standards, the river's flow below Franklin was 50% or more of treated effluent that was then added to by the two downstream STP dischargers. Dissolved oxygen levels slowly increased and were above or close to the state standard in the Harpeth over 30 miles downstream from the Cartwright Creek outfall in Cheatham County where the river's flow was ten times or more what it is through the Franklin and northern Williamson County area. (See attachment 8 for a short summary or the actual reports in attachments 2-7).

Thus, the Harpeth River in the summer season is violating water quality standards for dissolved oxygen when the city of Franklin's plant is discharging at less than half of its permitted design capacity with a very highly treated effluent that is well within the permit limits. From a review of Franklin's DMRs, the plant's effluent is consistently at a BOD_5 of 2 mg/l or less. The proposed permit limit for BOD_5 in the renewal is 4 mg/l which is based on the TMDL. At Franklin's design flow of 12 MGD, this is significantly MORE pounds of oxygen demand than the city currently discharges and the river does not currently meet the state water quality standards under these current conditions. This is the same for the other two permits. These field data findings essentially point to issues with key assumptions in the TMDL, and that it is time for investment in a new TMDL model. (Attachment 6-7).

Field data and analysis provided with these and TCWN's comments all indicate that the Harpeth River is not meeting water quality standards, especially dissolved oxygen, because of effluent discharges from these facilities. The Harpeth river's flow in the summer is so low that permitted effluent discharges can easily make up a significant percent of the river's flow (specific estimates provided in attachments 6-7). To quote Dr. Burkholder in her comments, the Franklin STP with a design flow of 12 MGD "can 'swamp' the natural flow of the stream (low flow 7Q10 is only 0.49 MGD)." Though Franklin's design flow is the largest, because of the river's summer low-flow conditions, both the much smaller Lynwood and Cartwright Creek sewer plants also contribute enough pollutant load to continue to reduce oxygen levels and add nutrients that feed algal growth in the river. Lynwood at 0.4 MGD contributes about 14% of the river's flow when the Harpeth is at low flow, 7Q10 conditions of 2.77 MGD. Cartwright Creek, though the smallest at 0.25 MGD, has such significant inflow/infiltration problems with its collection system, that its effluent flow is nearly double that. So, even this small sewer plant when compared to the large upstream Franklin facility still contributes around 10% to the river's flow during 7Q10, low-flow conditions (2.86 MGD in the river).

As Dr. Burkholder states for the Lynwood and Cartwright Creek permits, "discharge from the STP under its new permit will continue to contribute substantially to the nutrient/eutrophication-related impairment for the receiving segment of this 303(d) listed stream." She states the same thing for Franklin's permit: "discharge .... will continue to significantly influence" the Harpeth.

The analysis provided in the attachment to our comments from Aquaeter (attachment 1) come to the same conclusion based on TMDL pollutant load calculations for oxygen demand. Using the TMDL equation that requires a margin of safety, incorporating pollutant loading from nonpoint sources, and using the specific data derived from the EPA in its TMDL, the amount of pollutant load the Harpeth can assimilate at the point of Franklin's outfall is 130 lbs/day of BOD (biological oxygen demand.) EPA's TMDL in comparison is three times higher at 400 lbs/day. Aquaeter's work incorporates existing conditions in the Harpeth, whereas the EPA's TMDL made a significant assumption that the river in the summer would be above state standard of 5 mg/l. (The TMDL used 6 mg/l). With existing conditions, that include a 300 lb/day pollutant load from the Egyptian Lacquer chemical input from contaminated groundwater, 130 lbs/day is all there is in the Harpeth for the existing three sewer plants. This is significantly less than the proposed permits would allow and the current permits already allow.

Based on the field data and analyses summarized above, the draft permits appear to violate the Clean Water Act and the TN Water Quality Control Act by not setting permit limits so that water quality standards are met in the receiving stream which is the Harpeth (see citations in TCWN comments). In addition, permits cannot be authorized when "conditions of the permit do not provide for compliance with the applicable requirements of the CWA or regulations promulgated under CWA" (40 CFR Part D section 122.4 (a) and (d) and TWQCA 1200-4-5-.04(f)).

HRWA applauds the department in working on a watershed basis in these permit renewals. For the Harpeth river, this is the first time the 3 sewage treatment plants in Williamson County, which include the largest point source discharge in the river system, will have their permits synchronized for renewal. This enables TDEC for the first time to have all the permit holders, sister agencies, private sector experts, non-profit organizations, and the public focusing on

establishing a solution and/or a process for finding a solution that the permits can drive that will result in the Harpeth meeting the state dissolved oxygen water quality standard in the near future.

A key to this will be Franklin's work on its new Integrated Water Resources Plan (IWRP) which will be integrating stormwater runoff, effluent discharge, effluent reuse, and water withdrawal for drinking water. The city of Franklin has also set goals in its sustainability plan for a reduction in the flow of treated effluent into the Harpeth during the summer low flow season. Williamson County has taken a lead role in addressing failing septic systems in neighborhoods around Lynwood STP. Both this sewer plant and Franklin will be receiving the sewage from over 400 currently septic served homes that will reduce the nutrient enrichment into Lynwood Creek that is also listed on the 303(d) list.

Comments Applicable to all three proposed permits:

1. Based on current conditions in the Harpeth, less effluent discharge in volume and in concentration of pollutants needs to be instituted for the low-flow summer season than what current permitted and is in the proposed new permits. A waste load allocation and TMDL needs to be redone for the Harpeth. This can be put in motion as part of Franklin's insightful IWRP initiative. Also, Franklin should not shoulder all the work and cost for developing a WLA for the Harpeth all by itself both in terms of analysis and monitoring. Though, clearly Franklin will take the lead and will likely become the regional sewer system since it has a highly functioning STP that can meet tight effluent limits cost effectively and has already put integrated water management schemes into play, such as effluent reuse.

2. Aquaeter's comments offer an interim WLA for which to finalize the proposed permits for their short term period to the end of November 2011 that would apply for the summer, low-flow season. Establishing a waste load for the Harpeth in the vicinity of the discharges forms the foundation of a watershed based permit. Franklin can currently meet a 130 lbs/day load allocation in the summer since its effluent CBOD5 is very clean at just under 2 mg/l. At a 6 MGD flow, which is what the facility currently produces, and its current BOD5, the Franklin STP could meet this pollutant load. But, it would mean no discharge in the summer for Lynwood and Cartwright Creek (which wasn't even factored into the EPA TMDL.) Franklin in the summer season has been sending 3 -4 MGD of its effluent to irrigation reuse which does not get discharged into the Harpeth. With Franklin's effluent reuse that is already in place, there is some pollutant load that can be allocated to the two other sewer plants in the summer for the short term duration of these permits.

3. Along the same lines of moving to watershed based permitting, all 3 proposed permits need the same effluent concentrations. For example, the proposed permits right now have Franklin with a tighter BOD5 than the other two, and Lynwood with the tightest TN. All 3 have different proposed TP effluent limits too.

4. The Harpeth River segments that all 3 STPs discharge into does not meet water quality standards in the summer predominantly because of effluent discharge. Each permit at the beginning of the rationale section instead says the "division considers these conditions to be due primarily to non-point discharges rather than the permittee's treated wastewater discharge." The field data and analyses presented in these comments and the EPA's TMDL refutes this. The rationale statement needs to be edited to state that conditions in these

segments of the river are due to the permitee's treated wastewater discharge as well as to non-point discharges.

5. Each permit needs language that is similar to what is found in other TDEC permits, such as the construction general permit: "This permit does not authorize discharges that would result in violation of a state water quality standard."

6. Each proposed permit dropped the TMDL reopener clause. Is there other language that accomplishes the same intent? If not, we suggest it be put back in these permits.

7. TDEC should test each facility's effluent quarterly as an independent duplicate sample when the permittee does it. The permittee can pay for this cost. This test would be used to derive the CBODu/BOD5 ratio.

8. The permits should establish a goal or two for the Integrated Water Management Plan that Franklin has begun so that the effort which is intended to improve water quality in the Harpeth produces analysis relevant for all 3 permittees. One goal would be to establish a waster load allocation for the Harpeth. Another goal needs to be to require that Lynwood and Cartwright Creek participate and bring some funding to the effort. (See item #9 and #10 below).

Lynwood and Cartwright Creek permits:

9. The permits for Lynwood and Cartwright Creek need to require their participation and some funding that they bring to Franklin's IWRP process so that all the permittees are involved. The possible scenarios for an implementation plan for a TMDL on the Harpeth for low dissolved oxygen will need to involve all 3 sewer plants. The 3 sewer plant utilities, the city of Franklin and Williamson County have all had discussions already as the northern Williamson County area looks at regional sewer solutions.

10. Both permits need to also require the similar receiving stream investigations that are in Franklin's proposed permit. This might be the best way to essentially have all 3 permittees involved in the IWRP and combining resources for collecting water quality data that is needed to develop a new waste load allocation/new TMDL for the Harpeth for low dissolved oxygen and nutrient enrichment.

11. Lynwood's reserve sewer capacity was a significant step by TDEC when the facility was approved for expansion to address adjacent neighborhoods with failing septic systems. Williamson County leadership has spent considerable effort to now have the sewer hook systems underway. Some of the neighborhoods will actually now be served by Franklin. This is a major step toward regional sewer integration in this area. But, it is critical to keep this reserve capacity in place. Prior analysis provided by HRWA to the department two years ago when the utility wanted to accept almost 430 new homes found that it would be hard for Lynwood to meet its current permit limits as it comes closer to its design capacity as these septic homes are hooked up. We recommend keeping the reserve in place, regardless of the status of the septic hook-up program, since at Lynwood's current operation the river is not meeting standards in the summer.

12. The neighborhood in which Lynwood is located has complained again about odor. What can the department do with regard to the proposed permit to address this problem? The

Cottonwood development layout that this facility was originally built for did not provide much in the way of buffering space for the facility.

13. Cartwright Creek has a significant I/I problem that the department recognizes in the draft permit (page R2). This significant increase in rain and groundwater into the facility is compromising the treatment according to the draft permit. The proposed permit does not have specifics as to how the utility will address this which needs to be done. This issue should be part of the IWRP so that these costs are incorporated in alternatives analysis that the project will be developing.

This permit renewal is really the beginning of developing a comprehensive plan for the mainstem of the Harpeth River so that it meets water quality standards during the summer low flow season. HRWA has been playing a significant role in collaborating with various state and federal agencies, working with the sewage treatment plant permittees, and bringing in private outside TMDL experts to help contribute to creating the framework for a cost effective plan for sewage management for the large growth area of the Harpeth River watershed so that the Harpeth will meet water quality standards as soon as possible. HRWA is looking forward to being a member of the stakeholder group of the IWRP that has its first meeting December 17.

HRWA would like to convene a gathering of all the permit holders, their consultants, other agency experts, TDEC, and any other interested parties to host a presentation and discussion of all the dissolved oxygen data. HRWA will offer this as part of the something we can bring to the IWRP effort. Please do not hesitate to contact me with any questions on these comments and I look forward to working with all the stakeholders.

Sincerely,

Dorie Bolze

Dorie Bolze
Executive Director
(615) 790-9767 ext. 101
(615) 479-0181 (c)

Cc: Paul Sloan, Deputy Director, TDEC
Paul Davis, Director, Water Pollution Control, TDEC
Vojin Janjic, Permit Section, Water Pollution Control, TDEC
Saya Qualls, TDEC
Mark Hilty, City of Franklin director of Water and Sewer
Tyler Ring, president, Lynwood Utility District
Bruce Myers, regional manager, Cartwright Creek LLC
Dave McKinney and staff, TWRA
Steve Alexander, US Fish and Wildlife Service, Cookeville
Rogers Anderson, Williamson County mayor
John Schroer, city of Franklin mayor

Bill Melville, EPA
Tom McGill, EPA
Mark Nuhfer, EPA

Attachments:

Below is a list of the attachments and a brief description of their relevance. Some are on the HRWA web site (under Library/Scientific Studies), so their location is supplied so they can be printed out for the file. Most of these documents you and others in the department have received already. I will mail you a printed set as well. Please contact HRWA for copies of any of these attachments.

1. **Comments on the Harpeth River Watershed NDPES Permits**, by Aquaeter to Harpeth River Watershed Association, Nov. 25, 2009

This memo includes calculations of the waste load allocation based on current river conditions that can be established now to apply for all 3 permits for summer low-flow season discharges until a TMDL is redone.

2. **Dissolved Oxygen in the Harpeth River: August-September 2006. Final.** Harpeth River Watershed Association. Bolze, Cain, and McFadden. Feb. 2007.
http://www.harpethriver.org/library/library?id=55414

This report compiled Dissolved Oxygen data from various sources since the EPA's data for the TMDL in 2001 up to 2006. TDEC's diurnal monitoring data from 2002 and 2003 is in Appendix E. HRWA's first Dissolved Oxygen study from 2002 is Appendix F. The 2006 D.O. monitoring coordinated by HRWA and TDEC was comprised of 10 sampling sites, 3 of which were TDEC sites. Maps in the report help to locate all the sites along almost the entire mainstem from the headwaters to the take out point at the Harpeth River State Park. USGS data on flow during the monitoring is included as well.

3. **Dissolved Oxygen Study: June – July 2007. Final.** Harpeth River Watershed Association. By Cain and Bolze.
http://www.sitemason.com/files/bMJfB6/HRWA%20July%2007%20dissolved%20oxygen%20study%20final%20report.pdf

Eight sites were monitored in the segment of the Harpeth River through downtown Franklin to see if affects of dissolved oxygen could be captured from the chemically contaminated seeps into the Harpeth River and from seeps into Liberty Creek that flows into the Harpeth. The contaminated groundwater is from chemicals released by Egyptian Lacquer Manufacturing Company. The upmost site is above the lowhead dam , and the furthest downstream site is downstream of the Franklin STP outfall.

4. **Dissolved Oxygen in the Harpeth River: September 2007.** Harpeth River Watershed Association. By Cain and Bolze. (electronic file)

The report is complete but without a discussion section because the most recent version was corrupted. The file is a scan of a printed version. Figure 1 that displays all the site data is missing one site (#10 at RM 84.8), but the data from that site are in the report. Just like with the 2006

survey, TDEC placed diurnal monitoring probes at 3 of the sites. This year's survey was the most extensive in distance and in number of sites.

5. **Harpeth River Dissolved Oxygen Survey**: September 2008. Draft. (electronic file). This file has all the data from this year's survey in an excel spreadsheet with a summary table. TDEC wasn't able to employ the monitoring probes this year since they were in use in another watershed for the state's five-year cycle. The sites this year begin at the site below the Franklin STP outfall and the furthest downstream is at the Highway 70 bridge in Cheatham County.

6. **Water Quality Analysis: Harpeth River Between Franklin and Kingston Springs, TN.** Aquaeter. By Corn and Corn. For Harpeth River Watershed Association. September 2006.

http://www.sitemason.com/files/faR5Vm/Water%20Quality%20Analysis.pdf
This analysis discusses key assumptions in the EPA's TMDL for low dissolved oxygen, has estimated percentages of river flows that are treated effluent, and has TDEC's diurnal D.O. data from 2002 and 2003. Key assumptions in the TMDL include that the river will be at 6 mg/l of D.O. before the first STP outfall.

7. **Dissolved Oxygen in the Harpeth River: Connecting Point Source, Nonpoint Source, and Water Withdrawals.** Presentation to the TN AWRA by Aquaeter and HRWA. By Corn, Corn, Bolze, and Davee. April 2008. Powerpoint. (electronic file)

The powerpoint has EPA's Dissolved Oxygen data chart from the TMDL from August 2000 (p. 12), river flow data from the 2006 HRWA Dissolved Oxygen survey, three charts from TDEC's diurnal monitoring from 2002 and 2003 with estimated ranges of effluent percentage (pgs 14-16), and a simple mass balance for the Harpeth river to derive the flow needed to assimilate the design capacity of the Franklin sewer plant. If the Harpeth river just upstream of the Franklin outfall is 6 mg/l, then 96 cfs of flow is needed to provide enough oxygen to assimilate the effluent at the design flow of 12 MGD and current effluent concentrations. On page 23 is Figure 18 from the EPA TMDL that indicates that the BOD concentration in Franklin's effluent needs to be 3 mg/l for a 12 MGD design flow to meet the river's D.O. standard of 5 mg/l. This is lower than the 4 mg/l recommended in the TMDL summary table.

8. **Two Memos via email by Dorene Bolze, Harpeth River Watershed Association, to EPA, USFWS, TWRA, USGS, Aquaeter, and others, on findings from Dissolved Oxygen surveys**. March 08, 2007 re 2006 Dissolved Oxygen study and July 19, 2007 re June 2007 Dissolved Oxygen study in Franklin area. (electronic file)

The memos provide a summary of results that found low dissolved oxygen levels in violation of state water quality standards upstream and downstream of the various sewage treatment plant outfalls. Memos point to analysis of percent of river flow that is treated effluent during the monitoring period. Also discussed are assumptions in the EPA's TMDL for low dissolved oxygen and D.O. drop tied to the seeps of chemicals in the groundwater from Egyptian Lacquer.

HARPETH RIVER WATERSHED ASSOCIATION

June 27, 2013

Mr. Gary Davis
Tennessee Dept. of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex 401 Church St.
Nashville, TN 37243

Re: Request for a combined public hearing for the three draft NPDES sewage treatment permits on the Harpeth river in Williamson County: City of Franklin (TN0028827), Berry's Chapel Utility STP (TN0029718), Cartwright Creek (TN0027278)

Dear Mr. Davis,

This letter is an official request for a public hearing on the three draft NPDES permits for the three sewage treatment plants that discharge in the Harpeth in Williamson County. The state has been very accommodating of prior requests for public hearings on these sewer plant permits over the past 15 years and has held a joint hearing back in 2010 when the permits were first put on the same cycle. There has been active interest and efforts over the years by many entities and citizens to address sewer issues and undergo significant efforts that have improved sewer operations, provide centralized sewer treatment for some of the septic neighborhoods that have had problems, and much more. Through many efforts that have been discussed in prior comments and referenced in the permits, there is large number of well-informed people from all sectors who have been working on various aspects of the complex sewer issues in this area of the Harpeth related to the growth of the city of Franklin and northern Williamson County. A public hearing will provide the opportunity for TDEC to receive valuable input. Also it is common practice to hold a public hearing for a major source discharge which is the city of Franklin among these three permits.

HRWA and others have provided extensive analyses, data, information and comments on these three NPDES sewage treatment permits over the past 15 years. We want to confirm that the material provided to TDEC over the past several permit cycles by HRWA, including attachments, as well as those of TCWN and Dr. Joann Burkholder, an aquatic ecologist, who is the director of the Center for Applied Aquatic Ecology at NC State University are considered part of our comments related to these draft permits. It is more efficient to incorporate prior work that is still very relevant to the permits than to repackage such extensive material. TDEC has included comments letters from HRWA, TCWN, and others into the final permits and noted that material is in the permit file in the rationale section of the permits.

We appreciate the thoughtful consideration TDEC and many others have given to the work HRWA provided to TDEC, EPA, the permittees, and other agencies in February of this year that included a compilation of historical water quality data focused on dissolved oxygen, a draft water quality monitoring plan for the Harpeth, and a proposed structure and function for a Technical Advisory Committee (TAC). The TAC would oversee monitoring and needed studies, review data, assess the current TMDLs and oversee studies and efforts to develop revised TMDLs if deemed necessary, and provide recommendations for TDEC. As noted in the draft permits, TDEC agrees that more comprehensive instream data is needed. With increased instream monitoring required in the draft permits, it will be more efficient and cost effective for the permitttees to do this via a TAC. Other resources can be leveraged through a TAC such as the current opportunity described in our material with USGS and including stormwater jurisdictions that also have monitoring requirements in their MS4 stormwater permits, and others.

We note that the draft permits include the suggestion for participating in a TAC though the language in the draft permits does not require the establishment of a TAC. Also, the city of Franklin's permit has additional instream monitoring and river studies, but the other two permits do not include specific instream monitoring. HRWA provided a draft of permit language in February that incorporates a TAC and its function and timeline and that includes instream monitoring for each permit. These are slightly revised and attached below. It is important that all there permits includes instream monitoring requirements and the burden is not solely upon Franklin. While Franklin is the largest point source discharge at 12 MGD and the single largest source of BOD and nutrient enrichment, all discharges should be involved in instream monitoring since they are contributing to the pollutant loads. The approach of each permit having their own individual monitoring requirements but the option to participate in a collective monitoring effort is used in all of the current systems in place that HRWA reviewed and provided in our February material. We note that TDEC has modified the permit reopener clause to facilitate adjustments to the permit for the establishment and participation in a TAC and watershed monitoring plan and outcomes from the studies and nutrient management plans.

While it will take some time to establish the TAC and finalize a monitoring plan, data can be gathered by having the permittees provide funding for USGS water quality gages. Attached is a chart of the 6 locations from the monitoring plan. In the current permit for the city of Franklin, TDEC has already required diurnal monitoring in the Harpeth at 3 locations to gather Dissolved Oxygen data and other parameters between May and October. HRWA's work submitted in February provides a plan that can be used to have continuous monitoring deployed by this August in order to comply with this part of the current permit. It is not necessary to wait until next summer to have continuous monitoring data being gathered since it is a current permit requirement for one of the permittees now that has not been done. The 3 locations of the 6 that would be best to become active by August, would be the 96 bridge at Pinkerton Park to serve as a upstream of the sewer plant discharge location, Cotton Bridge (which is the relocation of the current USGS gage on Hillsboro Road bridge that was installed as a result of the sewer permit a few years ago), and Highway 100. All 3 are current USGS gage locations for river flow discharge data. Though continuous instream monitoring is not in the current permits for the smaller plants, with this requirement included in the new permits, the two could jointly fund the new gage at Old Hillsboro Road. Please note that these locations are based on a review of the existing data, and would be adjusted as to locations and length of time to be deployed based on the review of the TAC.

HRWA and EPA staff in region IV discussed HRWA's material and proposal of a TAC in March this year over a conference call. Mark Nuhfer offered that EPA would provide staff time to

participate in a TAC which is great news. As TDEC staff knows, the EPA conducted the field research and did the analysis, and wrote the TDML for nutrient enrichment and low dissolved oxygen for the Harpeth River. The key EPA staff involved in that work noted during the conference call discussion that with the removal of the lowhead dam a key condition that affected their modeling work is gone. The staff also noted that the ten years of dissolved oxygen data in the Harpeth that has been gathered by various entities and compiled by HRWA shows that a key assumption that the upper river system would reach water quality standards in a few years from when the TMDL was done in 2004 is no longer a valid assumption. With an unimpounded river and new river models that have already been adapted to the Harpeth with the city of Franklin's work in their Intergrated Watershed Management Plan, it is time to gather important water quality data by conducting the river studies outlined in the draft monitoring plan and incorporated into the draft city of Franklin permit.

The Harpeth River in the summer is a low flow river that is effluent dominated. As Dr. Burkholder stated in her review of all three permits in 2009, "discharge from the STP under its new permit will continue to contribute substantially to the nutrient/eutrophication-related impairment for the receiving segment of this 303(d) listed stream." As she noted with regard to Franklin, since it is by far the largest discharger with a design permit of 12 MGD, the city's "discharge .... will continue to significantly influence" the Harpeth. The city of Franklin does not discharge in the summer all of its effluent since it has an active effluent reuse program. According to charts produced during the IWRP and as seen in the DMRs, the city is currently discharging less than half of its permitted BOD5 load, very little of its permitted ammonia, but close to the permit limits on the load for total nitrogen. These charts are on pages 25-27 in the compilation of dissolved oxygen data report that HRWA produced and provided as part of our February 2013 material. Even though the other two sewer plants are so much smaller, during the river's summer low flows, these sewer plants still contribute enough pollutant load to affect the river's water quality as seen in the EPA's TMDL model and in analyses already provided. More detail is provided in the HRWA comments that are attached below.

TDEC needs to cap the loads in pounds/day that is currently being discharged by the three sewer plants. This cap would be set based on the current discharge loads if it is below the permitted limits, or set at the permit limits if the facility is currently discharging more than permitted (ie, Cartwright Creek for BOD5). Each sewer plant is discharging into the Harpeth when the river is not meeting dissolved oxygen standards; thus, the river in the summer does not have the capacity for the current loads not to mention the higher permitted loads set by the current permit for Franklin. In order to move toward solutions that bring the river's water quality up to standard, the current pollutant loads need to be capped at current levels until water quality data is gathered and assessed to determine what loads the river can handle, and plans are produced for how the facilities will be able to achieve what is needed. TDEC required Nutrient Management Plans from each facility in the current permit on how each will reduce nutrient inputs that are directly involved in the water quality violations during the summer. It is our understanding from reading the draft permits that these plans have not been developed for the two smaller facilities. The city's IWRP analysis shows that with the Franklin's long-term plan to expand sewage treatment to 24 MGD (double the capacity) the total Nitrogen loads would be higher in the winter than the current permit permits. HRWA would like to include in our comments those provided by TCWN recently that are focused on the need to address and reduce the permit limits for Total Nitrogen and Total Phosphorus.

As noted in prior comments, the city of Franklin is currently producing highly treated effluent and not discharging all of its effluent in the summer because of its effluent reuse program. Approximately 2 MGD of treated effluent is reused in the summer based on the DMRs and the permit renewal. The city has the ability to continue to add to its current facility more flow and still hold to its current total pollutant load through more effluent reuse and other means. A cap based on the current loads enables all three facilities to still accept more inflow as long as there are efforts to reduce the concentration or the amount discharge of effluent or a combination of both to maintain a cap at current loads or the permitted loads for facilities that are discharging more than permitted. Setting a cap at current pollutant loads is a transition measure since the current loads for all three permits still do not enable the river to meet water quality standards.

A review of the DMRs in each permit provides some insight to operations. While Franklin is meeting its permit limits, Cartwright Creek is struggling with high Inflow and Infiltration (I and I) problems. HRWA received a copy of a letter sent to TDEC and the utility recently from a River Rest home owner that found raw sewage in a drainage that flows into Cartwright Creek and into the Harpeth. Both this area of Cartwright Creek and the Harpeth are used by many to recreate. Bruce Myers explained to HRWA that a grease plug was found in the sewer line that has been remedied. This is current example of the need to upgrade collection lines that will reduce the flow. It appears from the DMRs for Cartwright Creek that the I and I flows are one of the reason the facility is discharging approximately 5 times the CBOD5 in pounds/day than the permit limit while the CBOD5 concentration was on average only half the permit limit.

Berry's Chapel has improved its treatment significantly over the years from when it was chronically violating the permit limits. The 125,000 gallon reserve that is still applied to the permit is partially responsible for the facility's ability to meet permit limits in the past few years since it is not handling flow at its design capacity, but only about half. The owners of the facility own property in the area and recently have had plans approved for approximately 20 new homes to connect to the facility. It is important to review closely the reserve that is still in place as a result of prior litigation because of the value the reserve capacity provides in helping ensure that the facility can operate within its permit limits. Nonetheless, as noted above, these permit limits do not ensure that the Harpeth is meeting water quality standards.

HRWA is willing to commit its efforts to help establish a functioning Technical Advisory Committee. Also HRWA is willing to help convene the many entities that could collaborate on creating long-term solutions for sewer that not only involve these three facilities, but HVUD and other sewer providers, the county who took on the hard but valuable effort of providing central sewer to hundreds of homes in septic communities in the Lynwood creek drainage area where systems were failing, and others that have a role in financial arrangements and sources of funding.

Thank you for considering our request for a joint public hearing. Based on prior experience with public hearings, we recommend that it be set up after school is back in session. A date starting the 3rd or 4th week of August would address that for the public schools and most private school, though most everyone is back from summer travels after Labor Day. This would enable more public participation on such an important issue that affects so many people who are not only sewer customers of the 3 facilities but also for the many people who live along the Harpeth and recreate in it. This area of the Harpeth is highly used for recreation in the summer and a powerful motivation for working hard to have the river in the summer meet all water quality standards.

Sincerely,

Dorene Bolze

Dorene Bolze
Executive Director
Harpeth River Watershed Association

cc:

Bob Martineau, TDEC Commissioner
Shari Meghreblian, Deputy Director, TDEC
Sandra Dudley, Director of the Division of Water Resources
Jennifer Dodd, TDEC
Alan Schwendimann, TDEC
Briton Dotson, TDEC
Wade Murphy, TDEC
Sherry Wang, TDEC
Ming Shiao, TDEC
Vojin Janjic, TDEC
Eric Stuckey, City Administrator of Franklin
Mark Hilty, City of Franklin, Director of Water Services
Tyler Ring, Berry's Chapel Utility
Bruce Myers, Cartwright Creek Utility
Jim Giattina, EPA Region IV, Water Protection Division
Chris Thomas, EPA Region IV, Chief, Pollution Control and Implementation Branch
Shawneille Campbell-Dunbar, EPA Region IV, Chief, TMDL Development Section
Mark Nuhfer, EPA Region IV, Chief, Municipal & Industrial NPDES
William Melville, EPA, Region IV, TMDL
Scott Gain, USGS, Director for TN
Shannon Williams, USGS
Steve Alexander, USFWS Cookville
David McKinney, TWRA
Rob Todd, TWRA

Attachments:

1. Draft permit language regarding monitoring and the TAC, including a proposed timeline for the TAC
2. Chart of six USGS continuous water quality and flow gages and partners
3. HRWA comments and proposal on monitoring and TAC, February 10, 2013 (referenced in the rationale section in all three draft permits)
4. HRWA comments on draft permits, December 1, 2009 (included in final permits issued in 2010 for Berry's Chapel and Cartwright Creek Utility)

Proposed permit language for 3 Harpeth River NPDES sewer plant discharges: Franklin (12 MGD), Berry's Chapel (0.4 MGD), and Cartwright Creek (0.25 MGD)

Proposed revisions to the NPDES Permit # TN0029718 for Berry's Chapel STP
6/27/13

Permit revisions

Insert new paragraphs 3.5 and 3.6 after Section 3.4 Placement of Signs. Sections 3.5, 3.6, 3.7, and 3.8 from existing Permit # TN0029718 will become Sections 3.7, 3.8, 3.9 and 4.0.

3.5 RECEIVING STREAM MONITORING/REPORTING

A Watershed Monitoring Technical Oversight and Advisory Committee otherwise referred to as the Technical Advisory Committee (TAC) will be formed to provide oversight and guidance on long-term monitoring requirements. The TAC shall finalize a watershed monitoring implementation plan; oversee water quality monitoring to evaluate the sufficiency of the current TMDLs; assist TDEC in developing new TMDLs as needed for any parameter with consistent monitoring results that do not meet state standards; and ensure that any changes in the watershed that may affect water quality will be reviewed and accounted for in future monitoring plans. The TAC shall oversee the development of a new TMDL as deemed necessary based on data.[1] Details on composition, responsibilities, and funding of the TAC are provided in Attachment 1. As a condition of this permit, the permit holder shall actively participate in and contribute to the TAC, including its establishment, continued work, as outlined in Attachment 1. Modifications to this permit must be approved by the TAC and TDEC.

3.6.1 Oversight Of Receiving Stream Monitoring/Reporting

The permittee must submit an implementation plan to TDEC and include sampling and analyzing procedures. The permittee is expected to follow approved plans. QA/QC procedures include: collecting and analyzing a trip, field, and duplicate blank with every 10% of samples, or once in every 10 samples. All meters must be calibrated upon use and have drift checks performed. All samples must be collected using EPA approved standard methods. The permittee will have a copy of the latest approved version of the monitoring plan in its permit file and on site.

The permittee shall complete the receiving stream monitoring and reporting consistent with the requirements established by the Technical Advisory Committee and approved by TDEC, as well as any revisions made over time. The permittee shall also be responsible for any future modifications to the monitoring/reporting requirements that are approved by TDEC and or TAC. The permittee shall be responsible for monitoring and reporting consistent at the following locations:

[1] Suggestion of technical trigger mechanism: for three (3) or more contiguous days during continuous monitoring OR for eight (8) different grab sampling events taken in the morning (before 9 a.m.) within a thirty (30) day period,

- Upstream site downstream of the confluence of Harpeth River and West Harpeth River near Del Rio Pike, RM 79 (approximately)
- Downstream of outfall, Harpeth River RM 75.3, TN46 Old Hillsboro Road

Sampling should be in coordination with TAC and nearby permittees. Once in effect, receiving stream monitoring/reporting consistent with the requirements established by the TAC and approved by TDEC, as well as any revisions made over time shall take the place of this set of NPDES permit requirements immediately.

3.6.2 Monitoring Parameters, Requirements, and Schedule

A. Chemical

Permittee is required to perform the following:

- Monitoring will occur from May 1st through October 31st for each year of the permit. Dry weather samples are to be collected no sooner than 72 hours after a rain event. Two dry-weather grab samples shall be collected monthly during the monitoring season, and at all aforementioned monitoring locations (see Section 3.6.1 for locations).
- Some monitoring will also occur during the period of November 1st through April 30th, in which the permittee will be required to collect one dry weather sample per quarter (November – January; February – April), at all monitoring locations.
  - Parameters included are:
    - Escherichia coli (E.coli)
    - BOD5
    - Ammonia-nitrogen (NH3)
    - Total Kjehldahl Nitrogen (TKN)
    - Nitrate-Nitrite
    - Ortho Phosphate
    - Total phosphorous
    - Dissolved Oxygen (mg/L, %)
    - Turbidity (NTU)
    - Total Suspended Solids – TSS (mg/L)
    - pH
    - Temperature (C)
    - Conductivity (micro-seiman/cm)
    - Flow (cfs)

- Continuous monitoring shall occur through financial support of a series of USGS gage stations as established by the TAC. The permittee's funding responsibility will be established by TDEC based on TAC recommendation and will include consideration of the permitted discharge. Continuous Monitoring parameters included are:
  - Dissolved oxygen
  - Turbidity
  - pH
  - Flow
  - Nitrate-Nitrite

- During the months of July and August, water quality sondes shall be deployed to collect diurnal data at all monitoring locations for five consecutive days. The sondes shall be set to collect data at 15-minute intervals for the following parameters:
  - Dissolved Oxygen (DO)
  - Temperature (C)
  - pH
  - Conductivity
  - Flow

B. Biological

Macroinverterbrate monitoring will be performed based on TDEC and/or TAC requirements.

(retain section B from Attachment 1, NPDES permit #TN0027278). Everything after Section B will be excised and replaced with above.

The above monitoring/reporting requirements shall be in effect until the Comprehensive Water Quality Monitoring Plan, is formalized by the TAC and put into effect.

This permit shall be modified to meet additional requirements of any newly adopted TMDLs. Refer to section 1.5 above, reopener clause, for the procedure for modifying the permit to be based on this new TMDL.

ATTACHMENT 1: Technical Advisory Committee details and implementation schedule
ATTACHMENT 2: Nutrient Management Planning (in current permit)

HARPETH RIVER WATERSHED ASSOCIATION

February 10, 2013

Mr. Gary Davis
Tennessee Dept. of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex 401 Church St.
Nashville, TN 37243

Re: Proposed Harpeth River Basin Water Quality Monitoring Plan and Technical Advisory Committee for consideration as part of the Harpeth river sewer NPDES permit renewals

Dear Mr. Davis,

Thank you for keeping us informed of the schedule for issuing the renewals of the three Williamson County Harpeth sewer NPDES permits: Franklin STP, Permit # TN0028827; Berry's Chapel Utility STP, Permit # TN0029718; and Cartwright Creek STP, Permit # TN0027278. Per our conversations in recent months, our understanding is that you are preparing to release draft permits soon and that you are interested in feedback from HRWA and others to strengthen the permit language and to incorporate a plan for water quality monitoring in the Harpeth. Since we provided you with a basic monitoring plan in May, we have worked further to refine it. The newer version along with a map of the monitoring sites is attached.

As I have mentioned to you, HRWA also has been looking for examples from around the country on how to create a technical advisory team that would oversea the final establishment, implementation and interpretation of a monitoring plan. HRWA has called this group a Technical Advisory Committee in these materials. We have attached a description of several from around the country that we used as models for this proposed structure and function of a TAC. The TAC would provide recommendations to TDEC for use in adjusting the permits, determining if a new TMDL is needed, and if so, providing the technical oversight for the modeling and data gathering for a new TMDL. We have provided text for a TAC and a sample time line as part of permit language. The draft permit language attached also focuses on integrating monitoring requirements into the three sewer NPDES permits.

As you know, the city of Franklin's permit has had water quality data gathering requirements for years, but only in the last permit cycle was continuous water quality monitoring on the river required in their permit. It would be most appropriate for all the sewer permittees and the stormwater permittees to be involved in monitoring and have it part of their permit requirements. The stormwater programs in the Harpeth are currently planning to monitor water quality as part of their MS4 permits and are very interested in coordinating efforts and gathering data that will be useful and have meaning as part of an overall river basin monitoring plan that looks all sources.

Since last fall, we have been in contact with permittees, the US Geologic Survey, and others to discuss the overall concept of the monitoring plan and the establishment of a Technical Advisory Committee (TAC). Those with whom we have spoken to in detail so far are amenable to moving forward using the common framework provided by a watershed monitoring plan and under the auspices of a TAC. In addition, USGS has committed to funding a substantial portion of the plan's one component to establish 6 continuous monitoring gage stations along the river. The extra stations and additional equipment only takes a few weeks to install once funding is secured. The goal would be to have them deployed by May to gather important data this coming summer. Four of these stations are already up and running and only require adding water quality parameters. Two new stations would need to be installed. USGS sees this as an excellent opportunity to undertake a pilot study in monitoring the nutrient, nitrate/nitrite. The table of continuous gage station sites, contributors, and costs is attached. This is a terrific partnership opportunity with the permittees funding the difference that is needed along with TDEC and TDOT maintaining or increasing their annual amount.

I have also once again attached our compilation of the ten years of dissolved oxygen data gathered by EPA, TDEC and HRWA, all of which shows conclusively that the Harpeth River is not meeting water quality standards in the low-flow summer months. Another map is attached that shows the locations of the various data gathering sites. As HRWA has noted in prior comments and analyses on the sewer permits and in other venues, the TMDL appears to have set the loads on the river too high. This is based on the fact that the river's DO levels are consistently below standards and the largest point source discharger (the city of Franklin's sewer plant) is not using more than half of the pollutant load allocated to them from the TMDL. In other words, during the summer the Harpeth does not meet state DO standards and the sewer plant is only discharging, on average, half of its permitted TDML load. The city of Franklin's plant is treating its effluent to a very high standard and currently discharges effluent significantly below its permit requirements that are set at the TMDL limits. The city also has an active effluent reuse program so that it is able to increase treatment capacity without it all having to be discharged to the river.

The state water quality standards require regulation of activities such that existing water quality levels are maintained or improved. As modelers like to say, field data trumps models. With the field data indicating continuing issues on the Harpeth and much of the entire length of the river not meeting state standards during the low-flow summer season, we strongly feel that it is time to put a detailed monitoring plan in place. The division is well aware that improvements in receiving stream water quality will require a coordinated effort on behalf of all the permit holders, agencies, and other affected entities. We offer these suggestions to provide for a pragmatic, empirical approach.

We respectfully request that the division consider the following while reviewing these permits: modifications to current permit language; a comprehensive watershed monitoring plan, and formation of a Technical Advisory Committee, to which TDEC may delegate primary responsibility for river water quality monitoring, data collection, interpretation, and oversight of the preparation of any new TMDL.

Permit language modification. We strongly reiterate our prior recommendations from the last permit cycle, along with TCWN's and Dr. JoAnn Burkholder's comments, that the permits include the following language, consistent with state law and with permits in other state water-regulatory permits: "This permit does not authorize discharges that would result in violation of a state water quality standard. Such discharges constitute a violation of this permit." (TDEC Rules,

Chapters 1200-4-3 and 1200-4-4.) In addition, there is some room to reduce the BOD5 load allowed in the city of Franklin's permit without putting too much of a burden on the permittee by reducing the permitted concentration of CBOD5 to a level between its current permit limit (4 mg/l) and what the facility is currently producing (1.42 mg/l) while keeping the design capacity at 12 MGD. The city is in process of working on re-engineering the current facility to increase its design capacity to 16 MGD. Ultimately, the permit issue is about the load that would be set which needs to be reduced from the current permitted amount. This would help guide the city's work on how to design for the increased design flow of 16MGD and meet a reduced overall BOD5 load into the river during the critical summer low flow months.

Establishment of a Technical Advisory Committee (TAC). We recognize the substantial burdens associated with comprehensive watershed management plans. We would welcome the opportunity to work with TDEC to organize and help coordinate a TAC. The Division has the authority to include the establishment of a TAC or any other conditions in NPDES permits pursuant to the federal Clean Water Act § 402(a)(2) and the Tennessee Water Pollution Control Act § 69-3-108(g).[4] There are further details in the proposed permit language that is attached.

In the fall, HRWA put in a proposal to the TN Healthy Watershed Initiative to fund an effort to establish and coordinate at TAC for 18 months and fund both a year of the 6 USGS continuous gage monitoring and a water quality modeling data gathering study. Though it was not selected for support this year, this effort can still move forward. HRWA would gladly convene a meeting with TDEC, USGS, the permittees, and other experts and agencies to pull expertise to discuss next steps toward getting the 6 USGS gages for continuous water quality monitoring operational by this summer and discuss the concept of a Technical Advisory Committee. The group could also focus on reviewing the current amount of Dissolved Oxygen and other data that has been gathered on the Harpeth and strengths and weaknesses of current river modeling efforts for future use.

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[4] CWA § 402(a) authorizes a federal NPDES permit program, while §402(b) authorizes a state program. Section 402(a)(2) authorizes the Administrator to "prescribe conditions for such permits to assure compliance with the requirements of [NPDES permitting scheme], including conditions on data and information collection, reporting, and such other requirements as he deems appropriate."
40 C.F.R. 122.44(d) reads in relevant part "In addition to the conditions established under §122.43(a), each NPDES permit shall include conditions meeting the following requirements when applicable... (d) any requirements in addition to or more stringent than promulgated effluent limitations guidelines or standards under sections 301, 304, 306, 307, 318 and 405 of CWA necessary to: (1) Achieve water quality standards established under section 303 of the CWA, including State narrative criteria for water quality..."
Section 69-3-108 of the Tennessee Water Pollution Control Act states in relevant part: **(g)** The commissioner may grant permits authorizing the discharges or activities described in subsection (b), including, but not limited to, land application of wastewater, but in granting such permits shall impose such conditions, including effluent standards and conditions and terms of periodic review, as are necessary to accomplish the purposes of this part, and as are not inconsistent with the regulations promulgated by the board. Under no circumstances shall the commissioner issue a permit for an activity that would cause a condition of pollution either by itself or in combination with others. In addition the permits shall include:

(1) The most stringent effluent limitations and schedules of compliance, either promulgated by the board, required to implement any applicable water quality standards, necessary to comply with an areawide waste treatment plan, or necessary to comply with other state or federal laws or regulations;
Regulations promulgated by TDEC and authorized by the Tennessee Water Pollution Control Act, Chapters 1200-4-3 and 1200-4-4: 1200-04-05-.04 prohibit the following: "(1) No permits shall be issued authorizing any of the following discharges: ... (f) When the conditions of the permit do not provide for compliance with the applicable requirements of either the federal CWA, or the Tennessee Water Quality Control Act (TWQCA);..."

We look forward to working with TDEC, the permittees, other agencies, and experts to move the watershed water quality monitoring and a Technical Advisory Committee to fruition.

Sincerely,

Dorene Bolze

Dorene Bolze
Executive Director
Harpeth River Watershed Association

Distribution List:
Bob Martineau, TDEC Commissioner
Shari Meghreblian, Deputy Director, TDEC
Sandra Dudley, Director of the Division of Water Resources
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Mark Nuhfer, EPA Region IV, Chief, Municipal & Industrial NPDES
Marjan Farzaad, EPA, Region IV, Chief Stormwater & Nonpoint Source Section
Scott Gain, USGS, Director for TN
Shannon Williams, USGS
David McKinney, TWRA
Rob Todd, TWRA

Attachments:
1. Comprehensive Water Quality Monitoring Plan for the Harpeth River Watershed—Sept. 2012
2. Map of monitoring site for the plan
3. Chart for 6 USGS continuous water quality and flow gages and partners
4. Examples of Technical Advisory Committees with draft language for one for Harpeth with timeline
5. Draft permit language specific to monitoring and the TAC
6. Compilation of Ten Years of Dissolved Oxygen Data on the Harpeth—powerpoint of slides that include summary charts from Franklin IWRP work.
7. Map of Dissolved Oxygen data sites over 10 years

HARPETH RIVER WATERSHED ASSOCIATION

November 13, 2013

Mr. Gary Davis
Tennessee Dept. of Environment and Conservation
Division of Water Pollution Control
6th Floor, L&C Annex 401 Church St.
Nashville, TN 37243

Re: Additional Comments on the three draft NPDES sewage treatment permits on the Harpeth River in Williamson County: City of Franklin (TN0028827), Berry's Chapel Utility STP (TN0029718), Cartwright Creek (TN0027278)

Dear Mr. Davis,

These public comments are submitted on behalf of the Harpeth River Watershed Association (HRWA) in addition to those submitted alongside our request for a public hearing on June 27, 2013. We also join in the public comments submitted by the Tennessee Clean Water Network (TCWN), Dr. George Garden, Mr. Kildgore, Mr. Turner, Ms. Holland, Patty Shultz on behalf of the Tennessee Scenic Rivers Association, and other members and supporters of HRWA. In addition to these public comments, HRWA requests that TDEC consider the public comments submitted by HRWA and others in prior permit actions regarding issues that continue to be pertinent to the impairment of the Harpeth River by the permittees in this action.

I. If these permits are to rely on Total Maximum Daily Load (TMDL) standards, a new TMDL for the Harpeth River for low dissolved oxygen and nutrient enrichment is required

A. The current TMDL is not protective of water quality and relies on faulty assumptions

The Harpeth River does not meet state water quality standards for dissolved oxygen (DO) (minimum of 5 mg/l) from the headwaters down to Kingston Springs, a distance of over 80 river miles. In our letter of February 10, 2013, HWRA provided a summary of the more than ten years of diurnal (24-hour) DO monitoring data that has been collected on the Harpeth by EPA, TDEC, and HRWA. A compilation of that data, a map of monitoring locations, and other material was provided to TDEC, other agencies, and the permittees. The EPA conducted the field research, performed the analysis, and wrote the TDML for nutrient enrichment and low dissolved oxygen for the Harpeth River, which was finalized in 2004. The field data was gathered over twelve years ago in 2000 and 2001. EPA staff involved in the formulation of the TMDL noted, during an EPA Region IV conference call with HRWA in February, that with the removal of the lowhead dam, a fundamental condition affecting their modeling work is gone. The EPA staff also noted that the

ten years of subsequent Harpeth River dissolved oxygen data gathered by various entities and compiled by HRWA shows that a key assumption – that the upper river system would meet water quality standards within a few years of the adoption of the TMDL in 2004 – is no longer valid.

These are the exact situations highlighted in the EPA Guidance on Revising and Withdrawing TMDLs (March 22, 2012). According to this guidance, it is appropriate to revise existing TMDLs when 1) modeling assumptions, data, or other information originally used … have significantly changed, or 2) when the TMDL is not resulting in attainment of water quality standards. Both conditions exist with respect to the Harpeth River Low DO/Nutrient Enrichment TMDL. Additionally, the guidance specifically points to TMDLs that include wasteload allocations for point sources predicated on anticipated nonpoint sources loading reductions. This is exactly the situation with the Harpeth Low DO/Nutrient Enrichment TMDL. The sewer plant wasteload allocations were based on the upper section of the river achieving a 65% reduction in sediment oxygen demand within a few years (p. iii). The key assumption made to get the river models to fit the newly expanded city of Franklin sewer permit was to assume that the river was coming into Franklin with 6 mg/l of DO and 17 cfs of flow. Both of these assumptions are not typical of low flow, hot, summer river conditions when DO has been recorded at 2 or 3 mg/l in downtown Franklin and a typical daily flow can be 2 or 3 cfs in late August and early September.

In the summer, the Harpeth River is a low flow river that is effluent dominated. As Dr. Burkholder stated in her review of all three permits in 2009, "discharge from the STP under its new permit will continue to contribute substantially to the nutrient/eutrophication-related impairment for the receiving segment of this 303(d) listed stream." She also noted that Franklin's "discharge …. will continue to significantly influence" the Harpeth River. As the DO monitoring data shows, the river does not meet state standards for DO upstream from Franklin. The city recognizes this fact clearly in its recent comments to TDEC on the draft permit, in Mayor Moore's statement at the public hearing, and in the report of the city's Integrated Water Resources Plan. The biological monitoring that the city has been conducting under its permit since 2001 substantiate that the river in Franklin is impaired with nutrient enrichment (see chart in Franklin's draft permit, p. R-32). All of the 3 sites for the past 12 years except one last year had scores indicating that the river is stressed. Notably the types of aquatic species found are tolerant of high nutrient concentrations. With the permits allowing discharge of biological oxygen demand (BOD) and nutrients that reduce DO in the river, the draft permits appear to violate the Clean Water Act and the TN Water Quality Control Act by not setting permit limits so that water quality standards are met in the receiving stream which is the Harpeth.[1] In addition, permits cannot be authorized

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[1] From TCWN's comments, November 30, 2009 on the 2009 draft NPDES sewer plant draft permits for these three facilities:

> Accordingly, the draft permits appear to violation Sections 402 and 302 of the federal Clean Water Act, 33 U.S.C. §§ 1342(b)(1)(A) and 1312(a), and Tenn. R. and Regs. 1200-4-5-.04(f) by failing to impose effluent limits that are sufficiently stringent to attain and maintain applicable water quality criteria for ammonia as nitrogen, Total Nitrogen, Total Phosphorus, and $CBOD_5$. *See also* 40 C.F.R. §§ 122.44(d)(1)(vii)(A) and 123.25.
>
> Issuance of the draft permit as proposed would also appear to violate Tenn. Code Ann. § 69-3-108(e) because it (1) would approve an activity that would cause a condition of pollution, and (2) fails to include the most stringent effluent limits necessary to implement applicable water quality standards for ammonia as nitrogen, Total Nitrogen, Total Phosphorus, and $CBOD_5$ in the Harpeth River.

when "conditions of the permit do not provide for compliance with the applicable requirements of the CWA or regulations promulgated under CWA."[2]

The river in the summer low flow season does not meet state DO standards, yet the city is discharging only about ***half*** of the BOD and Total Nitrogen load allocated to it in the TMDL. The TMDL set a summer season wasteload allocation of 400 lbs/day for BOD5 and an annual load of 290 lbs/day for Total Nitrogen. This summer, the city's average daily discharge of Total Nitrogen through September was 159 lbs/day, which is 54% of the wasteload allocation. In 2011, when the most recent diurnal DO monitoring on the river was conducted (which was by HRWA), the annual Total Nitrogen load was 46.6%. At that time two river miles upstream the DO was just above 3 mg/l in the early morning and was the same just downstream from the discharge at the Williamson Count Recreation center. The sampling sites recorded low DO concentrations of 2 mg/l and 3 mg/l downstream through Davidson County and was still below the standard at 4 mg/l at Hidden Lake state park which is on the Davidson/Cheatham County line.

The final permits need to state clearly that, if the relevant permit limits are going to continue to be based on a Harpeth River TMDL, a new TMDL that achieves water quality standards is needed. In the draft sewer permits, the rationale states that the "division recognizes that some TMDL updating may be warranted" (in Franklin's draft, p. R-4). As has been detailed in our prior comments, a Technical Advisory Committee (TAC) would oversee the data collection and preparation of a new TMDL.[3] The permittees would be involved in the TMDL formulation through the TAC and would provide funding for the needed work. In addition, a TAC offers opportunities for other funding and partners to be involved, which reduces the cost to the permittees. The TMDL would be based on creating a true "daily" load, as opposed to the annual average that is further divided into seasons by the current and draft permits.

B. Groundwater Contamination into the Harpeth from Egyptian Lacquer Manufacturing Company in downtown Franklin is undermining the validity of the wasteload allocation relied upon by the current TMDL

An important source of biological demand in the river that is reducing the DO concentration in downtown Franklin is the continuing seepage of contaminated groundwater from the Egyptian Lacquer Manufacturing Company (ELMCO), a small paint finishing outfit on Eddy Lane (see Attachment 1 which includes a map). The contamination was identified in early spring of 2007. After a legal settlement, a year of in situ BIOXX treatment was done, but a second year was not continued by ELMCO. As of the most recent well monitoring data in September, the main seep into Liberty Creek near the Harpeth River is still flowing with concentrations of toluene (114 mg/l) over 100 times the regulatory level of concern (1 mg/l). From the monitoring data, it is clear that there is still a huge quantity of chemicals in the ground at the ELMCO site. Six percent of the volume of the groundwater in one well is comprised of acetone. This is free chemical product! The toluene in the seeps at Liberty Creek represents a range of 90 lbs/day to 730 lbs/day of ultimate CBOD, depending on the volume of groundwater during dry and wet periods. Attachment 1 provides a brief summary of the current conditions of the continuing contamination and calculations of the ultimate CBOD that these concentrations represent going into Liberty Creek and the Harpeth River.

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[2] 40 C.F.R. § 122.4(a), (d); Tenn. Comp. R. & Regs. 1200-04-05-.04(1)(f).

[3] See discussion, *infra*, Section II. A.

The continuing chemical contamination at Liberty Creek is a large amount of CBOD, which essentially takes up much of the allocated load in the river that the TMDL has allocated to the sewage treatments plants. The total of 427 lbs/day of BOD allocated to the sewer plants is not there if that much BOD from the ELMCO chemical seeps is in the river upstream of all of the sewer plant discharges. Unfortunately there is no clean-up or final approved Corrective Action Plan. These sources of BOD are affecting the river's assimilative capacity, are undermining the fundamental wasteload allocation of the TMDL, and can be directly dealt with by TDEC.

II. Permit Comments in Common to all 3 Sewer Plants:

A. Support the formation of a Technical Advisory Committee (TAC) that is referenced in the draft permits. The draft permits need revision to *require* the formation of the TAC and outline its purpose, composition, and timeline of work. HRWA has provided draft language

HRWA has compiled examples of approaches in use around the country that coordinate water quality data gathering, TDML implementation, and integration among point source dischargers along a river and even other sources of pollution. In February of this year, HRWA provided extensive explanation of the use of a Technical Advisory Committee, including examples from other parts of the country, a draft comprehensive monitoring plan and continuous water quality monitoring stations, draft permit language to implement the TAC and expand ambient water quality monitoring requirements, and other information. This material was also provided to an extensive list of partner agencies, the permittees, and others.

The Technical Advisory Committee is an independent, interdisciplinary, advisory group and is not a regulatory authority. It makes recommendations to TDEC, which retains full authority. The purpose of the TAC is to finalize a water quality monitoring plan, evaluate data, oversee the development of a new TMDL, and oversee implementation. The TAC is comprised of various experts, members of various state and federal agencies, representatives of the sewer plant permittees and stormwater permittees, agriculture, and others, as drafted in the sample permit language provided in February. The draft language includes a time table for the work of the TAC. By including the TAC in the permits, there is a regulatory underpinning for the TAC and its function as a permit condition. A MOA would be written to further define roles, governance, function, and relationship to TDEC and the permittees. Very similar approaches are currently in use in North Carolina and around the country. The Division has the authority to include the establishment of a TAC or any other conditions in NPDES permits pursuant to the federal Clean Water Act § 402(a)(2) and the Tennessee Water Pollution Control Act § 69-3-108(g). HRWA is willing to invest our efforts in the TAC. EPA is supportive and has offered a staff person's time, and so are the USGS, TWRA, and the USFWS. Furthermore, a Vanderbilt Graduate student is already working on a study that will be of use to the water quality monitoring plan and TMDL.

B. Support the current requirement for each permittee to do a Nutrient Management Strategy and update it yearly:

The permits issued in 2009 all had this new requirement and provided some clear guidance on what TDEC was looking for, with each to determine ways to reduce nutrient loads. While none of the permittees have done this, it is clearly justified.

C. Support the need for a comprehensive water quality monitoring program and specific river studies that are needed to conduct a new TMDL on the Harpeth:

The 3 draft permits reference in the rationale that TDEC concurs with the need for in-stream water quality data and specific studies needed for a new TMDL. TDEC specifically calls for the city of Franklin to undertake some river studies, including a sediment oxygen demand study, time of travel study, and continuous monitoring. The smaller permittees did not have any ambient water quality monitoring requirements included in their draft permits. However, HRWA strongly believes that all permittees need to be responsible for gathering the needed water quality studies and regular monitoring data. It should not be the responsibility of one of the permittees. However, it will be much more efficient and would generate high quality data if the monitoring is designed and managed by the TAC. The permittees would contribute financially based on their pollutant load, and staff of the permittees can be trained to take on aspects of monitoring in order to reduce costs. The TAC would finalize and revise the monitoring plan, which would be allocated to each permittee and others who participate. The TAC would manage any consultants contracted to do work under the TAC such as some of the river studies and TMDL modeling. There are more details and examples of TACs and monitoring programs from other parts of the country submitted in our material earlier this year. In particular, North Carolina has some good approaches that can easily be used here.

A TAC also offers opportunities for other funding sources and academic involvement to defray costs to permittees. Should one of the permittees decide not to participate in the TAC and organized monitoring, HRWA provided a draft for the Receiving Stream Investigations Appendix for each permittee.

D. <u>The permits need to require that each provide funding to launch the continuous water quality monitoring program with 4 -6 USGS gauging stations so they are operational by May 2014</u>.

HRWA worked with USGS, TDEC modeling and TMDL staff, and other experts to create the proposal which was submitted to TDEC in February. HRWA even identified possible sources of funds to bring to the effort There are other partners, such as TDOT and USGS, that might still have funding to bring to this, since it also helps them meet some of their permitting and/or program goals.

E. <u>Specific input on monitoring proposed on the permits as requested by TDEC</u>:

The draft city of Franklin permit also has some specific changes and additions to current data studies that TDEC has requested. A biological monitoring sampling study is proposed in the comprehensive water quality monitoring that expands on the sites Franklin is already doing under its current permit. The small facilities are proposed to do two locations apiece as well.

1. Expanding the bio assessment monitoring that has been done by the city for over 10 years. The two additional sites: one has already been suggested to be at Cotton Road (per our submitted draft permit language on monitoring for all 3 permits in July).

   The other "downstream sufficient dissolved oxygen reference station" in the draft permit is likely not possible or the best approach. The benthic monitoring will indicate overall stream health or stress based on the aquatic biota. These scores are not easily correlated or causally related to one water quality parameter such as dissolved oxygen. This is a discussion for the TAC.

2. Bioassessment is expanded beyond the 5 sites proposed for Franklin (4 in HRWA's proposal already submitted) and 2 for each of the other sewer plants:

   Berry's Chapel—upstream of outfall but downstream of West Harpeth confluence
   Old Hillsboro Road bridge (also a continuous monitoring USGS gage site)
   Cartwright Creek—50 feet upstream of outfall
   Upstream of Moran Road bridge (versus 150 yards downstream of outfall as in our proposal).

F. Support the flexible re-opener clause in the 3 permits:

We support the intent to enable the permits to be adjusted more flexibly than once in a five-year cycle as work is accomplished by the permittees on their nutrient management plans, data from river studies and monitoring are gathered, a new TMDL is completed, and proposed changes are recommended by the TAC. With a more collaborative and integrated approach founded on water monitoring data to guide permits adjustments, it will be of value to the permittees to have a flexible reopener clause to implement changes to foster adapative management that can be of benefit to them.

G. Re-word the paragraph in the rationale section of each permit that states that "the division continues to consider the not fully supporting condition to be due primarily to non-point discharges (including upstream inputs) rather than the permittee's treated wastewater discharge."

This statement needs to be corrected. The Harpeth River downstream from Franklin through at least Williamson County is very much "effluent dominated." The Harpeth is a groundwater-fed low-flow river in the summer (as shown in the compilation of Dissolved Oxygen Continuous Data on the Harpeth provided with prior materials in February and July). The river's 7Q10 statistic for extreme low flow conditions at the city's discharge is only 540,000 gallons a day. The city's permitted discharge is 12 MGD! As Dr. Burkholder stated in her reviews submitted on the permits in 2009, the city's discharge swamps the river and significantly influences it. Even the two small sewer plants will affect the river's eutrophication and nutrient driven water quality problems. Charts and graphs submitted in prior permit comment periods show that the river was 35%-90% effluent downstream of Franklin during times that TDEC had set out 3 week continuous Dissolved Oxygen monitoring. During this period concentrations of 1.5 mg/l – significantly below the standard of 5 mg/l—were recorded. Given the substantial effects that the permittees discharges have on the flow and content of the river – self-evident by the fact that the river is often primarily effluent in impaired portions – the permits need to revise their language to recognize the permittees' contributions, as well as upstream input contributions, to the river's impairment.

H. Establish mass loads (in lbs/day) from the TMDL as a MONTHLY average (in lbs/day) to be reported every month and set a daily maximum load of two times the monthly average. A daily average that is calculated over an entire year or 6 month season is meaningless.

The current permits integrated the TMDL annual loads of Total Nitrogen into the permit with one annual report of the daily average based on averaging across the entire year. This allows loads to be significantly high during some months if it can be low enough during other months to make the annual average meet the TMDL limit. This can enable loads to be higher in the summer during the river's stressful season. The annual load (expressed in lbs/day) should be set as a

monthly average (as was done with the seasonal loads for CBOD5 and ammonia from the TMDL) with a daily max of no more than twice the daily average. The monthly average should be reported on the next monthly operating report.

I. The permit concentration limits for nutrients—Total Nitrogen and Total Phosphorus—need to be reduced in the 3 draft permits to reflect technically feasible levels.

Algae in the river is fed by the input of nutrients, especially nitrogen in the Harpeth where soils are already rich in phosphorus. High nutrient levels discharged feed algae growth, alter the types of algal species, and during low flows can cause algal blooms. Details have been discussed in other materials in the record that support that the Harpeth dissolved oxygen levels are also affected by algae. TDEC refers to its new Nutrient Reduction Strategy for setting permit limits for nutrients that it is developing for the Harpeth as part of the Cumberland River Basin. TDEC will do this with data from the US Geological Survey in about two years according to the draft permit. With the significant algal influence on DO levels in the river, it is justified to set limits in the permits at levels that are currently or can be technically achieved now.

J. Establish a percentage of effluent in the river during the summer as a permit control to accomplish both a reduced pollutant load in the summer and to eliminate odor issues:

The reduced nutrient concentrations, along with reductions in BOD for the city of Franklin, can be coupled with a limit on the volume of effluent discharged to meet the reduced load limits for these pollutants. In addition, setting a percent effluent limit in the river during the summer will address problems of odor on the river, a problem familiar to the many people who recreate on the Harpeth. The percentage of effluent should not be above 50% in the winter and 10% in the summer in order to protect aesthetics and recreational use. In addition, an odor survey should be done for all 3 facilities.

Setting a maximum percentage of river flow for effluent discharge is similar to the city of Franklin's water withdrawal permit, which limits the city to withdrawing water based on a percentage of the river's flow. The percentage would be based on an instantaneous flow of the river that is measured from the nearest USGS upstream. When the USGS continuous water quality monitoring gauges are installed (based on the 6 locations proposed in our earlier comments), there will be an appropriate USGS gauge for each sewer plant to use. Nonetheless, the permit should specify that the river's instantaneous flow should be measured by a flow gauge operated to provide real-time data for the public view, and the sewer plant will be responsible for removing obstructions in the area of the gauge. The permitee's discharge flow also needs to be provided to the public in real-time and for archiving. The percent effluent would be reported on the monthly report and calculated as frequently as possible with a daily average. For the small sewer plants that may not discharge continuously, the permit needs to specify how frequently in a day to measure the effluent flow to establish a effluent percent that is measured no less than two times a day when discharging.

K. Conduct an Odor Survey for each sewer facility, especially Franklin's, to eliminate the odor in the river downstream of the dischargers in the summer:

Public comments at the hearing pointed out that the river has a noticeable odor downstream of the city of Franklin's discharge point. HRWA staff and others have noted this "chlorinated or funky cement pipe smell" when on the river in various areas downstream of the Franklin sewer plant and around Fieldstone Farms (about 3-4 river miles). It is likely occurring

downstream of the other two facilities, especially in drier summer conditions. The permits need to require all three to conduct odor surveys via serial dilution in order to determine what percentage of the effluent in the river does not cause a noticeable odor for people recreating on the river.

The Harpeth River is highly used as a recreational resource (one of its designated uses under the TWPCA) from southern Williamson County all the way to the river's confluence with the Cumberland River. In the vicinity of the three sewage treatment plant dischargers, there are sections of the river that are very popular for tubing, paddling, swimming, and fishing during the summer. HRWA is working with the city of Franklin Parks Department and Tennessee Scenic Rivers Association to add canoe accesses along the Harpeth through downtown Franklin to enable more river access. The Civil and Criminal Liability Section of the permits (Section 2.4.1) states clearly that "it shall be the responsibility of the permittee to conduct its wastewater treatment and/or discharge activities in a manner such that public or private nuisances or health hazards will not be created."

L. Ammonia limits: Review permit limits to incorporate the new ammonia ambient water quality criteria recommended by EPA this summer:

In August 2013, EPA published new national recommended ambient water quality criteria for the protection of aquatic life from the toxic effects of ammonia.[4] These new national criteria incorporate the latest toxicity information for freshwater species, including unionid mussels and gill-breathing snails, and have reduced the criteria concentrations. Species of these sensitive organisms are found in the Harpeth River, as documented in a TWRA mussel survey as part of the HRWA Characterization Study of the impoundment behind the city of Franklin's lowhead dam, the Army Corp of Engineer's Harpeth River Reconnaissance Study, and Parmalee and Bogan's, The Freshwater Mussels of Tennessee (1998).[5] While the city of Franklin's permit has low ammonia concentrations, the other two permittees do not and need to have their ammonia limits reduced to at least mirror those in Franklin's draft permit. In addition, the current city of Franklin permit ammonia limits also need to be evaluated and possibly reduced based on the new EPA recommended criteria.

M. No more hook-ups to the two small sewer plants, and a limit to only adding new hook-ups to Franklin's sewer plant to those developments with final city approval as of November 12, 2013.

Details supporting this for each sewer plant is provided below in Parts III, IV, and V. Overall, the reason for the need for limiting new hook-ups is fundamentally because the river does not meet water quality standards in the summer both upstream and downstream of each discharge. As discussed above, a permit cannot be issued under state and federal law that causes pollution.

N. Specific language in the permit liability section:

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[4]Federal Register Volume 78, Number 163, Thursday, August 22, 2013, pp. 52,192-52,194.

[5] HRWA would like to adopt as part of this permit record these 3 reports and the entire record of comments and attachments submitted during the comment period by HRWA, TWRA, USFWS, the World Wildlife Fund and The Nature Conservancy for the 2007 ARAP water withdrawal permit issued to the city of Franklin (NRS06.332) and the new one issued in 2013 (NRS12.195). We also adopt into this permit comment record HRWA's permit appeal of this permit. All of these materials can be found in the TDEC permit record for the city of Franklin ARAP water withdrawal permit except for the USACE, Harpeth River Reconnaissance Study, May 2012.

The liability section of each permit needs to include this language found in similar TDEC permits, such as the construction general permit: "This permit does not authorize discharges that would result in violation of a state water quality standard. Such discharges constitute a violation of the permit." This has been raised in prior comments.

O. Quarterly Total Nitrogen and Total Phosphorus monitoring:

All three current permits contain a provision stating: "Total Nitrogen and Total Phosphorus monitoring – report quarterly influent and effluent average concentrations, mass loadings, and percentage removals based on quarterly monitoring." This monitoring provision has been removed from all three of the permittees' draft permits and needs to be reinstated, particularly since none of the permittees has yet to comply with this provision, which would provide valuable information concerning their operations and nutrient impairment of the river.

P. Permittees need to fund TDEC cross testing of sampling and for BODu:

From a review of the last five years of monthly monitoring reports, the two small sewer plants have reported problems with their sampling which is the basis of the effluent reporting. The city of Franklin also continues to push against the CBODu/BOD5 ratio applied to its effluent. It is important that there be independent and unannounced sampling at each facility and that the facilities need to provide funding for the lab costs for TDEC to do this regularly. This interval from weekly, monthly, or quarterly or otherwise will vary by parameter and facility. It is also important to review the labs used by the permittees to ensure that the dilutions used and testing done do not mask the actual concentrations in the samples.

III. Specific Comments on the Draft City of Franklin Permit:

A. Support more specificity on the diurnal investigations of dissolved oxygen and other parameters during the summer:

TDEC required diurnal water quality monitoring in the city's permit, which has not been done. The city does gather water quality data from the river, but these are grab samples. For dissolved oxygen, which falls at night to a low early in the morning then rises to a high in the middle of the afternoon, this daily swing is critical to capture for any meaningful understanding of the conditions in the river and for conducting river models for the TMDL. So much of the DO data in the river is grab data, which typically is collected during the work day and misses the high and low of the day. Also, this requirement can be met or replaced by language to participate in funding the 6 USGS continuous monitoring stations.

In this draft permit, of the four proposed locations (one more than the in the current permit), the location at Hillsboro Road bridge (Site HRD1) could be dropped. After reviewing the decade of diurnal DO data gathered, this location and on downstream near the elementary school (Hunters Bend in Fieldstone Farms) is where the influence of the high oxygenation of the effluent can be seen. The oxygenation by the sewer facility to the effluent will create a brief increase in the river's DO, even though it is temporary and only masking the slow loss of DO caused by the rest of the effluent components as the river and effluent mix and flow downstream. The super oxygenation of the treated effluent provides a temporary hit of oxygen to the water that is brief and quickly disappears within a few river miles of the outfall point. In discussions with USGS on the proposed continuous monitoring sites, the USGS gauge at the Hillsboro Road bridge would be moved to Cotton Lane. The gauge at Hillsboro Road is there not for long term research and

survey purposes by the USGS, but as a monitoring location paid for by the permittee. As the river research progresses, one outcome will be to locate the various spots along the river where the DO drops to its lowest point as a result of the effluent discharge from each facility (what the river modelers call the "DO sag").

B. Remove the current monthly average summer Total Nitrogen load of 377 lbs/day:

This monthly average load per day was a carry-over from two permit cycles ago and is higher than the TMDL annual daily average load of 290 lbs/day. TDEC incorporated the TDML annual day average in the 2009 permit, but did not remove the now outdated and higher 377 lbs/day. It doesn't make sense to have a higher daily average load in the summer when the river system is most affected by nitrogen loading than the annual daily average. The 377 lbs/day summer monthly average per day does not conform to the TMDL.

C. Reduce concentration of BOD5 to 2 mg/l which is HALF of current permit because the city's sewer plant is consistently meeting this; reduce the BOD mass of the permit in HALF to 200 lbs/day.

As stated above, the Harpeth does not meet dissolved oxygen standards in the summer often prior to the discharge point as well as afterwards. This is with the city's load input at less than half the TMDL wasteload allocation of 400 lbs/day. The city's monthly reports show that it is consistently producing effluent with 2 mg/l or less of BOD5. Since 2 mg/l is the detection limit, this should be the new limit for the monthly average concentration. The daily maximum would be adjusted down accordingly to 4 mg/l which is two times the monthly average.

D. Reduce the Total Nitrogen concentration from 5 mg/l, which does not comply with TMDL, to 2.9 mg/l which is in the TMDL.

The permit's current Total Nitrogen concentration of 5 mg/l with the 12 MGD design flow is over twice the TMDL's average daily load of 290 mg/l. The permit cannot continue to set the concentration above the TMDL limit. The city consistently produces effluent with concentrations around or below this concentration, so it is technically feasible.

E. Reduce the Total Phosphorus proposed concentration from 3 mg/l to 0.6 mg/l.

The current permit limit of 5 mg/l is so far above the city's capabilities that it is irrelevant. The reduced concentration to 0.6 mg/l for Total Phosphorus is derived from the ratio that is optimal in an activated sludge sewage treatment plant (BOD5:TN:TP is 100:5:1). With the Total Nitrogen set at 2.9 mg/l, as proposed above, the Total Phosphorus concentration that goes with this ratio is 0.6 mg/l. This concentration for Total Phosphorus is still significantly higher than the eco-region reference concentration of 0.18 mg/l for this ecoregion,[6] which is the concentration proposed by TCWN. In addition, the grab samples that the city has been doing as part of their permit ambient water quality testing shows the concentrations in the river around 0.6 mg/l (data chart of 3 sampling sites in Franklin's draft permit at page R-28).

F. Support the current permit's basic approach of having both concentration limits and total mass limits for the nutrients nitrogen and phosphorus:

[6] Denton, Arnwine, and Wang, Development of Regionally-Based Interpretations of Tennessee's Narrative Nutrient Criterion, TDEC, 2001. For ecoregion 71h and 71i, TP- 0.18 mg/l and for Nitrate + Nitrite-0.92 mg/l.

In its comments, the city noted that it has discussed with TDEC the removal of concentration limits for nitrogen from the permit. This is not acceptable and should not be adopted. Aquatic wildlife and many chemical and biological processes are affected directly and in the short term by concentration. If concentration is removed, discharges can have high concentrations that would not be prevented by having a permit limit based on solely meeting a pollutant mass limit. The city and its consultants are proposing this as way to loosen the permit conditions to enable an increase in the sewer plant's capacity from 12 to 16 million gallons a day and still discharge mostly into the river in the summer. Removing the concentration limit dramatically restricts enforcement as well. With a concentration limit, a sample of any volume of effluent would need to meet a concentration limit at any given time. A mass limit is based on the concentration and the volume of effluent with that concentration.

G. Place moratorium on city approval of new sewer capacity by prohibiting approval of new development for which the city proposes to provide sewer via the sewer plant.

The city of Franklin's sewer plant is handling at and above its design capacity of 12 million gallons a day as of 2013 based on the monthly operating reports. According to the letter from TDEC dated July 9, 2013, TDEC calculated an average 13.4 MGD from January through May of 2013. In addition, the city has already approved nearly 7000 new homes/residences that are not yet hooked up to the sewer treatment plant. HRWA compiled the number of 6828 in unbuilt residences by reviewing the city's 2012 Development Report[7] and the approvals of new developments in 2013 through the Nov. 12, 2013 Board of Mayor and Aldermen (BOMA) meeting. A table in the report totals 5,454 unbuilt residences in approved subdivisions. In 2013 thus far, another 1,374 or so residences were approved. These approved, but not yet built, homes approximate another 2 million gallons a day of sewer flow based on the figures used by SSR.[8] This firm is the city's consulting engineer who is currently updating capacity and projected sewer needs in each sewer drainage basin. This additional 2 million gallons will mean that the city's plant will be regularly receiving flows above its 12 million gallons a day. In these conditions violations are more likely since the plant is receiving volumes of untreated sewage above the capacity it was designed to treat.

A large proposed subdivision for people 55 years and older by Del Webb will be before the city on December 10 for consideration of annexation. This is another 718 homes and approximately 250,000 gpd. The more sewer capacity approved, the more the city is in the position of having committed to provide beyond its currently approved system can handle. This is already an issue, as noted by Ann Morbitt at TDEC in her July 9, 2013 letter to the city. She notes that the city is currently not able to operate three "oxidation ditches," which at times "reduces the treatment capacity of this facility to below the average influent flow rates." (para. 8). Capping the approved future demand at what has received final approval by the city's BOMA as of November 12. 2-13 will provide the time needed to conduct the river studies and prepare a new TMDL. The new TMDL will provide an updated pollutant loads of Total Nitrogen, Total Phosphorus, and BOD that are needed for designing the sewer system to accommodate possible expansion. The time can also be focused on designing the land application for the expansion of effluent reuse. Fundamentally, the cap on new sewer customers is justified because the permit

[7] http://www.franklin-gov.com/Modules/ShowDocument.aspx?documentid=14720.

[8] SSR uses 350 gallons per day (gpd) for a single family residence; 250 gpd for multi-family; 0.15 gpd/sft for retail; and 0.10 gpd/sft for office. In 2013 only residential has been newly approved. A proposal to expand the Galleria Mall by 73,7000 sft is under consideration which represents 11,055 gpd of sewer flow.

allows discharges when the dissolved oxygen levels are below state standards.in the river which means there is little assimilative capacity.

H. The city's effluent reuse program is a crucial part of the overall system and needs to comply with the rules for land application sewer disposal systems:

A critical part of the city's sewer system that will be part of the solution to reducing pollutant loads in the river is the effluent reuse program that the city started nearly 15 years ago. The city has at least two golf courses that take effluent for irrigation purposes and store it in ponds on site. The city has a set of local regulations that relate to charging for reuse, requiring sewer line laid (the purple pipe) with new sewer to take reuse water back out to new developments, and more. Land application sewer systems are permitted by the state with a State Operating Permit that prohibits any discharge of the effluent, sets concentrations and sampling, and requires the submittal of extensive engineering plans. Over the years as the city has developed the reuse program, TDEC incorporated the components of the State Operating Permit into the NDPES permit as opposed to issuing a separate SOP. Has the city also complied with section 1200-1-6 with regard to the reuse program which is essentially a land application sewer system?

The city's sewer system is really a combination of a discharge and land application system. The combined system needs to be designed based on the pollutant load limit and volume limit that can be discharged into the Harpeth in the summer. The remaining effluent will need to be treated on land or sent to another sewer plant like the Harpeth Valley Utility District (HVUD) or Metro Nashville, both of which discharge into the large Cumberland River. Currently, the city's effluent reuse program is more of an add-on. During dry summers there is more effluent reuse demand by the golf courses, but in a wet, cool summer like this past summer, there is much less demand and the effluent is discharged to the river instead. This can be seen by examining the monthly operating reports. As an example, for the months of July in 2010, 2011, and 2012, the average volume of effluent reuse was 3.8 MGD, 4.49 MGD, and 4.34 MGD, respectively. During these three months of July, 50% or more of the total effluent was NOT discharged, which meant that only 3 to 4 MGD on average was discharged. This past summer, the average volume of effluent reuse was only 1.58 MGD, only 17% of the total effluent average flow. This meant that 9.24 MGD was discharged into the Harpeth, which was TWICE the volume of the prior 3 months of July. This clearly indicates that the effluent reuse program is not intentionally designed to handle a certain amount of volume and is currently set based on the weather conditions and current user demand.

Land application based sewer systems require engineering to determine application rates, access, and control of the land so that the city has control of the amount of volume it can apply. Land application sewer systems also contribute nutrients to the environment so local surface waters will need monitoring in strategic areas around land application areas. The design for a land application of sewer has its own complexities related to weather and the seasons. Essentially, during the summer the city's sewer system will be more of a land application program and in the winter, when the river volume is high and temperatures are lower, the city's sewer system will be predominantly a discharging system. It is time to push the effluent reuse component into more intentional design and regulatory oversight so that opportunities to secure land for application and areas for storage are secured in the midst of the expanding growth in the city's undeveloped areas that could also be valuable for the sewer system.

I. Comments on various charts in the permit appendix related to Dissolved Oxygen sampling, outputs from the IWRP and so forth:

The two charts of DO data on pages R-30 and 31 connect isolated grab data taken a few times a month over several years. At first glance the undulating graph looks like one generated from 24-hour monitoring sampling, which is not the case. These charts should NOT connect these dots. Also, most important is that the TIME OF DAY these grab data were taken is not indicated. These data in this presentation are meaningless without the time of day. As explained above, dissolved oxygen varies over a 24 hour period. The lows will be early in the morning before the sun rises. The highs will be in the late afternoon. Most grab data does not capture either the extent of the swing each day or the low readings because grab data is mostly taken during the work day. It appears that the grab data chart on the two preceding pages contain the DO data shown on the graph. The staff did a great job of collecting the data as early as they could, around 7:10-7:30am. But the lowest readings are around 6am in the summer before the sunrises.

The charts on page R-35 have the same problem since the time of day is not indicated. I have the excel spreadsheets of this raw data and most of this was collected between 10am and 2pm. The data can be useful to calibrate river models if the time of day is known so the data can be matched to that time of day.

J. Alterations in permit monitoring parameters that need to be fixed

The draft permit contains several changes to the monitoring parameters that TDEC has made either accidentally or without adequate explanation of the reasons for alteration. First, the parameters for silver and selenium that are listed for semiannual monitoring in the current permit are not present in the draft permit. The parameter for winter Total Nitrogen daily mg/L has been omitted from Franklin's draft permit, though it remains in both Cartwright Creek's and Berry's Chapel. The draft permit also provides for monitoring of summer Total Phosphorus daily lb/day, a parameter not contained in any previous permit, while omitting summer Total Phosphorus daily mg/L. The provisions for summer CBOD monthly lb/day and winter CBOD monthly lb/day appear to have been switched with each other. Finally, the parameter for summer Total Suspended Solids monthly lb/day has been omitted.

K. Changes in frequency of monitoring

The draft permit should reflect the frequency of monitoring being performed by Franklin. The measurements for Total Nitrogen and Total Phosphorus should be taken once per seven days, and parameters subject to semiannual monitoring should be changed to quarterly.

IV. Specific Comments on the Draft Permit for Berry's Chapel Utility:

A. Keep the 125,000 gallon reserve in place:

TDEC imposed this reserve capacity at the time of the permit expansion in order to have capacity to connect hundreds of homes on septic in the nearby vicinity of the plant. As has been described in prior comments and in the permit, Williamson County has successfully carried out its Grassland Sewer project to serve the septic neighborhood and ultimately has an agreement for the city of Franklin to serve these areas versus Berry's Chapel. Not all of the communities in grassland on septic will be served at Franklin since they are close to the Cartwright Creek facility, which cannot handle any more capacity.

The draft permit and TDEC correspondence to the utility has found Berry's Chapel in violation of its permit for failing to collect sampling information correctly since 2010 on key

pollutants in its effluent. As a result, the results on their monthly operating reports for removal of TSS (suspended solids), CBOD, ammonia, and others parameters are questionable. This means we do not know what level of pollutant load the sewer plant is actually contributing to the river even if the reports indicate that concentrations are below permit limits. The reserve limits new capacity, which will limit any increase in pollutant load from the facility since the river is not meeting standards upstream and downstream of the discharge point.

B. Keep the financial requirements in section 3.8 that TDEC is proposing to remove:

Citizen comments made at the public hearing outlined extensive financial issues including misused funds for non-sewer plant expenses that can all be found documented in the Tennessee Regulatory Authority record involving numerous rate cases. Mr. Kildgore provided a set of materials for the permit record at the public hearing addressing the issue. The facility even changed its name and corporate entity from a private to non-profit in an attempt to be out from under the regulatory purview of the TRA so that rates could be raised more aggressively. The Attorney General eventually ruled that Berry's Chapel was still regulated by TRA and even owed funds back to customers. Clearly sound financial management is important to being able to meet the other conditions of the NPDES permit. The financial requirements provision should remain to protect the water quality of the river as well as the rate payer.

The NDPES permit grants permission to use the public's natural resources as long as water quality standards are met. The permit does not give a right to pollute. If the owner of the facility can not meet the permit conditions, then the state needs to initiate efforts to find a new operator who is able to meet the permit conditions or otherwise provide sewer service to the customers. TDEC and TRA need to work on a joint agency effort to accomplish this if the Berry's Chapel Corporation does not want to spend the funds it receives from ratepayers to operate the facility within permit conditions.

C. No more hook ups:

This condition needs to be a part of the final permit for the reasons outlined above. The moratorium needs to stay in place until there is at least a year of compliance with every aspect of the permit including any sections that might be appealed and at least a year of following the financial requirements.

D. Reduce the concentration for Total Phosphorus from 5.7 mg/l to 1 mg/l:

As stated above, Total Phosphorus concentrations of 5.7 mg/l are so much higher than the ambient river concentration as to be meaningless in managing for load reduction. While the monthly reports indicate that the plant is not removing Total Phosphorus to this suggested level, it is technically feasible to do so.

E. Reduce Ammonia Limits in Summer and establish limits for the Winter to at a minimum match those in Franklin's permit:

As discussed above in the section above on comments applicable to all 3 sewer permits, EPA published new ammonia water quality criteria standards in August 2013. Ammonia is toxic to aquatic life and EPA's new recommendations reduce these standards to reflect new research on the sensitivity of fresh water mussels and gill-breathing snails which are found in the Harpeth. Berry's Chapel's current permit has no set winter ammonia limits and the summer limits are

higher than for Cartwright Creek, which is a smaller facility. In reviewing the utilities monthly operating reports, the facility can clearly meet the much lower ammonia standards currently in the Franklin permit and the final permit should at least reduce ammonia limits in the summer and set them for the winter similar to Franklin's. In addition, TDEC should review the EPA's new recommended ammonia water quality criteria and reduce the permit limits further based on this review.

V. Specific Comments on the Draft Permit for Cartwright Creek:

A. The permit needs to establish a compliance schedule to address and fix the significant and well documented problem with Inflow and Infiltration (I/I) which causes the plant to violate the permit.

TDEC has noted in the permit rational section for several permit cycles that I/I is a significant issue for Cartwright Creek. A look at the last five years of monthly operating reports indicates that the flow through the plant is *double* its design capacity. This dilutes the system such that it cannot remove enough of the Total Suspended Solids or BOD to meet permit conditions on a regular basis. The comments on the draft permit from Bruce Myers at Cartwright Creek specifically acknowledge that the facility cannot meet the Total Nitrogen limits. In 2011 and 2012, the small facility discharged 2.2 and 1.4 *times*, respectively, the annual mass of Total Nitrogen in lbs/day that was allocated to it in the TMDL (15 lbs/day). The independent analysis provided in the record by George Garden, PE, Vice-President at Barge Waggoner engineering firm, found the I/I to be one of the highest in the state at likely 2/3 of the flow into the plant. Until this is addressed the sewer plant cannot meet its permit limits; thus, a compliance schedule is essential in the final permit.

B. No more hook ups:

This condition needs to be a part of the final permit for the reasons outlined above. The moratorium needs to stay in place until there is at least a year of compliance with every aspect of the permit including any sections that might be appealed. This essentially means no more hook-ups until the dramatic I/I problems are addressed and found successful through at least a year of compliance.

C. Add the same or substantially similar financial requirements as those in Berry's Chapel's current permit:

Citizen comments made at the public hearing referred to financial management issues with Cartwright Creek LLC that are also part of the TRA public record. Cartwright Creek was purchased from the prior owners knowing of the facilities I/I problems. The owners are not prioritizing funds to fix the I/I problems. As discussed above with Berry's Chapel Corp., the NDPES permit for the sewer plant does not give a right to pollute. If the owner of the facility can not meet the permit conditions, then the state needs to initiate efforts to find a new operator who is able to meet the permit conditions or otherwise provide sewer service to the customers. TDEC and TRA need to work on a joint agency effort to accomplish this if Cartwright Creek does not want to spend the funds it receives from ratepayers to operate the facility within permit conditions.

D. Reduce the concentration of Total Phosphorus from 3.5 mg/l to 1 mg/l:

According to the monthly reports, the facility is currently producing effluent at around 1 mg/l so this limit is technically feasible.

E. Reduce Ammonia Limits in Summer and establish limits for the Winter to at a minimum match those in Franklin's permit:

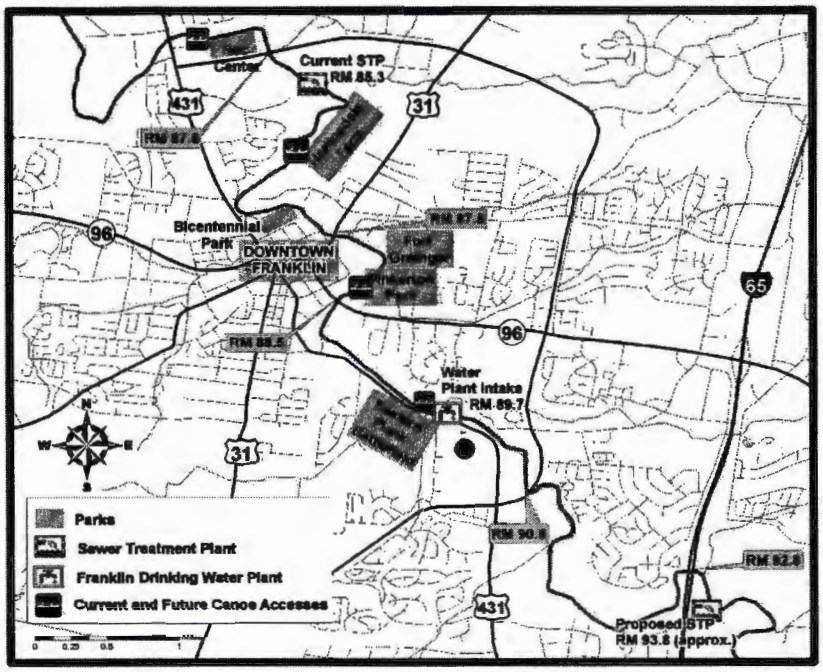
As discussed above, EPA published new ammonia water quality criteria standards in August 2013. Ammonia is toxic to aquatic life and EPA's new recommendations reduce these standards to reflect new research on the sensitivity of fresh water mussels and gill-breathing snails which are found in the Harpeth. Cartwright Creek's current permit has no set winter ammonia. In reviewing the utilities monthly operating reports, the facility can clearly meet the much lower ammonia standards currently in the Franklin permit and the final permit should at least reduce ammonia limits in the summer and set them for the winter similar to Franklin's. In addition, TDEC should review the EPA's new recommended ammonia water quality criteria and reduce the permit limits further based on this review.

F. Changes to the permit monitoring parameters

The draft permit requires Cartwright to report winter Total Phosphorus daily lb/day, while omitting winter Total Phosphorus daily mg/L. This should be changed so that winter Total Phosphorus daily mg/L is a required parameter. Total Phosphorus daily lb/day is not required for the other permittees and can be omitted.

VI. Some comments related to the city of Franklin's Integrated Water Resources Plan

The city of Franklin invested $2,000,000 to conduct a forward thinking attempt to integrate the various programs: drinking water, sewer, effluent reuse, stromwater, and stream restoration. The IWRP was completed in February 2012. This plan grew out of the city's several year effort to secure an ARAP water withdrawal permit for the expansion to 4 MGD of its small drinking water plant that currently still produces 2 MGD. During the permitting process with all of the various analyses, it became clear to the aldermen and the public that the city actually relies on purchased drinking water from Harpeth Valley Utility District which the city tied onto in the 1980s. The Harpeth is such a low flow river in the summer that it has never been the sole source for drinking water even when Franklin was a town of 5500 people in the 1950s. Several years ago, debate on whether to increase or shut down drinking water production from the Harpeth was put aside to do the integrated analysis that would consider all of the systems. A key point raised during the water withdrawal was the effect on the river's assimilative capacity for the city's sewer plant discharge in the summer. TDEC issued an ARAP for the withdrawal setting conditions on the withdrawal, but the city did not expand the facility during that 5 year period. The city approved expenditures for engineering a new, same capacity drinking water plant, but the final decision on whether the city will continue to pull water from the Harpeth or finally let it go is still to come. Both the city and HRWA have filed permit appeals on the recently issued new TDEC ARAP water withdrawal permit that reduced the percent withdrawal from 20% to 15%.



The primary goal of the IWRP was to look at some big picture options for planning to double the capacity of the city's sewer processing capacity from 12 to 24 MGD. Above is a map of the 7 river miles through downtown Franklin showing five city and county parks linked by the river. The sewer plant is downstream just upstream from the Rec center canoe access. The city purchased land in the floodplain several years ago that is about 3 river miles UPSTREAM of the city's aging drinking water plant. One of the options that became the preferred one by the consultants and city water and sewer senior staff is a "toilet to tap" option. This involves constructing a 6 MGD sewer plant upstream so that the treated effluent in the summer would "augment" the river's flows to support a new and larger 4 MGD drinking water plant that still would not be able to operate at capacity in the summer. Another option analyzed is to have all 24 MGD sewer capacity at the current location and no longer withdrawal from the Harpeth to produce drinking water. A third option dusted off some old work to consider a pipeline to the Cumberland River to bring raw water down to process in the city at a new drinking water plant. There were two other options looked at as well. None included investigation of a pipeline to the Cumberland to discharge treated effluent or to hook into either Metro or HVUD's sewer system.

This draft final Integrated Water Resources Plan from July 2012 by CDM Smith has been provided to TDEC and TDEC has been given the sense that Alternative 1, "Toilet to Tap" option, was approved by the stakeholders and possibly the city Board of Mayor and Aldermen. This is not the case for either. There is lots of great work in the IWRP, but there are important aspects and limitations to it that need to be part of the permit record. Many of the summary statements in section 4.2.4 are biased enough that they need to be addressed.

1. As far as the issue of approval or recommendations from the Stakeholders involved in the IWRP, please see attached my memo to the Board of Mayor and Aldermen in April 2012. In this memo I had to clarify that the stakeholders did NOT vote on any final alternative. Most of the stakeholders were government officials and felt that their role was to advise and not direct or tell the aldermen how to spend city funds. Some stakeholders did vote or voice their option. HRWA in my memo went on record not supporting the "Toilet to Tap"

approach. Also, in May 2012, the city aldermen did NOT vote for this alternative either. They voted to approve components of various options analyzed by the IWRP. These included approving the work to do engineering to increase the sewer plant to 16 MGD, to engineer simply replacing the drinking water plant at its current capacity of 2 MGD, and some other components. After all not all of these expensive capital costs are needed at once. I can provide that material if needed and it is on the city's meeting web site.

2. A "river model" in the context of one based on new river field studies and analysis that would form the basis of a new TMDL has not been done with the IWRP. Modeling was done using a model designed by TVA that TDEC supported, but it was not used to produce a model that could determine whether an option would bring the river up to water quality standards. The modeling work was more appropriately called a Predictive Screening tool. The intent was to see if there were some distinct differences in the 5 options that would kick one or more out of consideration. It is perturbing to see the IWRP and city comments imply that the IWRP involved a new river study as if it was the basis of a TMDL and that there was significant field work performed. The IWRP did not conduct any field work.

3. In the draft IWRP report, CDMSmith says that the effort was not intended to find the option that would bring the river to water quality standards. Unfortunately, that is what most of the aldermen expected. There was much disappointment when the work became framed as looking for the option that "didn't make the river any worse after it left Franklin." This is reflected in some of the final results when looking at the table in section 5-2. There is no difference to speak of between the options as to the amount of lbs/day of BOD or TN that is produced. The numbers in the chart are a bit different, but with all the assumptions and the scale of the work, the difference is minimal if it is real at all. The reason that there was little difference among any of the options is based on the fact that there was little difference in the amount of effluent discharged among them. No option was based on an aggressive land application during the summer that would reduce effluent volume significantly compared to the others, for example. The similarities in loadings of BOD and TN are easy to see on the bar charts that have the TMDL loads marked on them. The one showing the Total Nitrogen loads is below. The IWRP did not find an option that met the TDML's Total Nitrogen load which means the IWRP did not provide any engineering optimization of the treatment system that TDEC is expecting from doing a Nutrient Management Plan as specified in the permit. Instead discussion has been on seeing if TDEC will increase the loads in the winter.

4. The modeling work done to screen the various options was not able to incorporate the entire load at 24 MGD of treated effluent without cutting the amount of Sediment Oxygen Demand in HALF. CDMSmith tried to use the SOD field data collected by EPA for the TMDL, but the DO charts dipped way below the minimum of 5 mg/l. Also the modeling did not line up the output of its DO data to the city's field, grab, data based on the time of day that the city's data was collected. This had the added effort of adjusting the model's output of DO data up along the graph since the grab data was not capturing the low values found in the early morning or late night. The effect of using HALF of the SOD data and "curve fitting" to the city's DO grab data was that the lines shown on the example DO chart in the Franklin draft permit is HIGH, moved up the scale about 2 -4 mg/l.

5. CDM's modeling staff met with interested stakeholders, such as HRWA and the US Geological Survey and HRWA experts, to review and discuss the modeling. There is no

doubt that the EPA's 3 SOD field values are not robust, still the values are in line with what to expect in the Harpeth. In the summer it is shallow and warm and moves slowly. This allows sediment to have a reasonable influence in reducing DO in the water. Modeling is unfortunately rife with lack of data and sensitivities to a key assumption. The important point is that the outputs from the model did not find any of the IWRP options that would keep the DO at or above standards. Essentially the charts really should be about 2 mg/l lower. This means that 24 MGD of treated effluent in the river is NOT going to be assimilated by the river in the summer. Also the options that would work have not been analyzed yet and probably can't be until river studies are done and a new TMDL prepared.

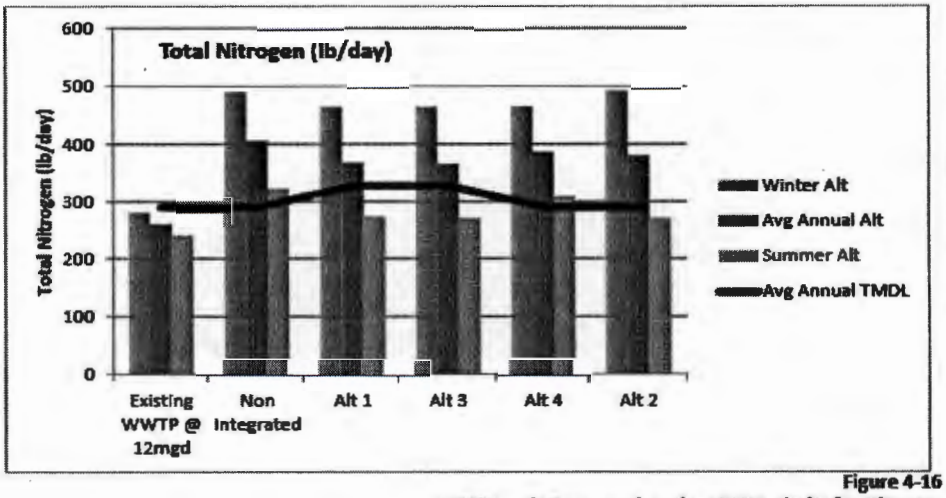


Figure 4-16
IWRP Loads Compared Against TMDL Limits for Nitrogen

p. 4-23 City of Franklin, TN, Integrated Water Management Plan, Draft Report, July 2012, CDM Smith.

6. The entire IWRP effort worked off of the pollutant wasteloads set by the EPA's TDML. As discussed extensively in documents in the permit record, it is clear that the TMDL did not set the loads at levels to enable the river to meet standards. HRWA and other stakeholders promoted at the beginning of the IWRP process that one or two different vales representing lower loads be used for the analysis as well. That was not supported.

7. This river model also did not work at flows in the river below 5 cfs. While an improvement over the state of the art when the EPA did its work, the river regularly sees daily flows in the summer of 2 and 3 cfs and the 7Q10 is LESS still at 0.84 cfs. The river must meet water quality standards at 7Q10 flows by law.

8. The IWRP has put too much emphasis on the sediment oxygen demand of material along the river bottom as the primary reason the river doesn't meet water quality standards upstream of the city of Franklin's sewer discharge point. The groundwater contamination by ELMCO is one example of a loading in the river that is not SOD. Also upstream sources can be addressed. HRWA has been doing this in the headwaters with agricultural

best management practices. The town of Eagleville is finally building a non-discharging sewer plant that will address failing septic that is widespread in the town because of the perched water table in the headwaters.

9. The IWRP document and the city's comments clearly state that the river is impaired and that the Harpeth does not meet water quality standards before the sewer plant discharge. As has been pointed out in these comments, discharging a pollutant into receiving waters that do not meet standards for that pollutant or because of it is not allowed.

10. It is important to stress that the IWRP completely ignored the effect of having an effluent dominated stream flowing through downtown Franklin. The plan views the "Toilet to Tap" proposal as if the effluent is simply more river water when it will create odor and introduce contaminants into the drinking water supply. Sewage treatment plants do not remove all the potential harmful substances such as pharmaceuticals and personal care products, hormone derivatives, organic chemicals, and others depending on the sewer system and customer base. Current Safe Drinking Water Act regulations and guidelines do not address scenarios for effluent-dominant systems. According to the National Academy of Sciences report on Water Reuse that came out in 2012, there are no standards based on science set up to protect public health when it comes to direct reclaimed water reuse as of yet.

Please do not hesitate to contact me if you need any further material much of which can be accessed from our web site.

Sincerely,

Dorene Bolze

Dorene Bolze
Executive Director
Harpeth River Watershed Association

Attachments:

1. "Liberty Creek Flow and Oxygen Demand: ELMCO Solvent Release Response" to HRWA by Global Consulting, Nov. 12, 2013
2. May 3, 2012 memo from Dorie Bolze to Franklin BOMA on role of stakeholders in the IWRP. No vote on options done.

cc:

Bob Martineau, TDEC Commissioner
Shari Meghreblian, Deputy Director, TDEC
Sandra Dudley, Director of the Division of Water Resources
Jennifer Dodd, TDEC
Alan Schwendimann, TDEC
Briton Dotson, TDEC
Wade Murphy, TDEC
Sherry Wang, TDEC
Ming Shiao, TDEC
Vojin Janjic, TDEC
Eric Stuckey, City Administrator of Franklin

P.O. Box 1128 ■ Franklin, Tennessee 37065 ■ Phone: 615-790-9767 ■ Facsimile: 615-790-9767 ■ www.harpethriver.org

Mark Hilty, City of Franklin, Director of Water Services
Tyler Ring, Berry's Chapel Utility
Bruce Myers, Cartwright Creek Utility
Jim Giattina, EPA Region IV, Water Protection Division
Chris Thomas, EPA Region IV, Chief, Pollution Control and Implementation Branch
Shawneille Campbell-Dunbar, EPA Region IV, Chief, TMDL Development Section
Mark Nuhfer, EPA Region IV, Chief, Municipal & Industrial NPDES
William Melville, EPA, Region IV, TMDL
Scott Gain, USGS, Director for TN
Shannon Williams, USGS
Steve Alexander, USFWS Cookville
David McKinney, TWRA
Rob Todd, TWRA

HARPETH RIVER WATERSHED ASSOCIATION

May 3, 2012

Dear Mayor Moore, City of Franklin Aldermen, and Eric Stuckey

RE: Item 14: Language in resolution (2012-18) re IWRP projects on role and approval of a Preferred Plan (Option 1) by the stakeholders

As you know, I have represented HRWA as a stakeholder in the city of Franklin's Integrated Water Management Plan. HRWA has been very supportive of this important effort that the city has undertaken to plan for its sewer and drinking water needs for the next 30 years. CDM Smith and city staff have put in significant effort and prepared numerous technical documents that are very valuable in guiding the Board of Mayor and Aldermen's decisions in continuing to upgrade and fund the many aspects of the city's sewer and drinking water system. Stakeholders have also provided valuable input and time. HRWA has provided CDM Smith with everything in our files and met with CDM Smith staff on several occasions outside of the formal stakeholder meetings to discuss certain aspects of the work, such as the water quality modeling effort.

Earlier this year, presentations of the IWRP Phase II efforts were given and a proposed priority list of projects was presented and discussed during several BOMA work sessions. At one of these, the question was raised as to the role of the stakeholders and whether there was an actual vote on the various Alternatives analyzed in the Phase II effort. The draft resolution (2012-18) that accompanies the proposed project list states that "the Stakeholders and Steering Committee have approved a Preferred Plan (Alternative 1) that provides a list of projects and/or policies needed to implement the intent of the IWRP." In addition, a statement read by Mayor Moore at the most recent BOMA Work Session did clearly frame the stakeholder role as that of officially approving Alternative 1.

During the April 10 work session I provided oral comments regarding my recollection on the role of stakeholders and the process of the Phase II analysis of the alternatives. Since not all of the members of BOMA were present at that work session, it seemed appropriate to provide this officially in writing. During the October 2011 stakeholder meeting, the CDM facilitator at one point asked each attendee their position on each of the alternatives after the presentation. I recall some people saying they were. I recall that stakeholders in attendance that represented state and federal agencies, local governments, and utilities made statements to the effect that for various reasons it was not appropriate for them to approve or disapprove of an alternative. Many stated that they felt their role was

advisory. I remember one or two stakeholders stating that it didn't feel appropriate as an outside entity to imply or dictate policy guidance which is the role of BOMA. I stated that I was not supportive of the outcome presented for a number of reasons related to work on the water quality model, concerns that Alternative 1 presented significant regulatory issues, and concerns about having the results presented to the stakeholders that afternoon with no time to review, among other points that I raised at various times during the IWRP effort.

HRWA's concerns with aspects of the IWRP work does not negate the vast amount of valuable work that has been done and is being used to guide important sewer and water infrastructure decisions. Nor would it be appropriate for HRWA to speak for any of the other stakeholders on their recollection or perspective on their role. It was suggested during the IWRP work, that the final report on Phase II and the statement describing the stakeholder involvement be circulated to the stakeholders for review prior to finalization of that report. The list of stakeholders is on page 3-4 of the Phase I IWRP report that is on the city's website if you have an interest in contacting them.

HRWA has participated in numerous stakeholder processes like the IWRP. A similar one was the 840 Task Force that worked on modifications to the route of a contentious section through southeastern Williamson County. In that situation, two different statements were prepared that each stakeholder signed related to the preferred alternative route. The work was provided to Governor Bredesen who was the decision-making authority to choose the final route. In other similar task force or stakeholder efforts that I have participated in, the members are noted for their input but were not decision makers. The subsequent report reflected that the findings or preferred options were based on input from the advisors/stakeholders but the decisions or preferred options were set by a different decision-making body or the authors. With the regard to the nature of the function of the stakeholders for the IWRP, a statement as to their role in the final Phase II report will clarify their involvement versus those of the Steering Committee or others with regard to any recommendations of alternatives and options.

While there are differences on aspects of the IWRP work, I want all of the members of the board of mayor and aldermen and city staff to know that these are to be expected as part of the nature of these complex issues. HRWA appreciates and recognizes each of your care, concern and desire to improve and maintain the health of the Harpeth River that flows through downtown Franklin. Each of you care for the Harpeth River and for the city of Franklin.

Sincerely,

Dorene Bolze

Dorene Bolze
Executive Director

P.O. Box 1127 ■ Franklin, Tennessee 37065 ■ Phone: 615-790-9767 ■ Facsimile: 615-790-9767 ■ www.harpethriver.org

BLACK & VEATCH

3011 Armory Drive, Suite 220
Nashville, TN 37204-3721

Tel: (615) 248-2666
Fax: (615) 248-8666

Black & Veatch Corporation

City of Franklin, Tennessee
WWTP Renovation to 12 mgd

B&V Project 97374.320
B&V File A
October 28, 2003

Ms. Sibyl Cole
Standards, Monitoring and TMDL Branch
U.S. Environmental Protection Agency, Region IV
Water Management Division
61 Forsyth Street, S.W.
Atlanta, GA 30303

Subject: Draft TMDL for Harpeth River Watershed

Dear Ms. Cole:

We have reviewed the draft TMDL for Waters in the Harpeth River Watershed (HUC 05130204) with the City of Franklin and developed a list of questions and comments. We would like to convey to you our questions and concerns with the draft TMDL as summarized below. We request that you consider and incorporate our concerns in the final TMDL.

1. In the draft TMDL report, allowable loadings and allocations are first developed for the nutrients nitrogen and phosphorus. The percent reductions required for each sub-watershed are presented in Table 16 of the report.

   The report next discusses the procedure used to develop the TMDL for dissolved oxygen (DO). The primary factor affecting DO is the high sediment oxygen demand. EPA estimated that reductions in sediment oxygen demand (SOD) would be directly proportional to loadings of nutrients. Using the water quality model, EPA determined that for the existing conditions, a 40 percent reduction in nutrient loadings and SOD would be required to achieve the DO criteria of 5 mg/L. EPA also concluded that for the existing condition, the reductions in nutrients that would be required to implement the nutrient TMDL would also result in the DO criteria being met. This would occur because for the two sub-watersheds in the area of problem DO concentrations, the required reductions are 45 to 49 percent total nitrogen and 82 to 84 percent total phosphorus.

   The report then examines the future condition and the expansion of the Franklin treatment plant. Using the model, EPA estimated that a 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) concentration limit of 4 mg/L would be required. However, the modeling was conducted using nutrient reductions of 40 percent i.e., the required value for the existing condition, and not the expected higher reductions percentages. If the model were run using the expected values noted above, the estimated limit for $CBOD_5$ would be greater. We request that this issue be examined further and the model run using the expected nutrient reductions.

2. In the draft TMDL report, the WASP6 model used ultimate CBOD to calculate impacts on dissolved oxygen. As indicated on page 51 of the draft TMDL, EPA analyzed two samples of

Franklin WWTP effluent to determine the ultimate CBOD to $CBOD_5$ ratio and selected the more conservative (higher) of the two results (a ratio of 5.3) for use in the water quality modeling. The draft TMDL report acknowledges that the ratio of 5.3 used in the load allocation is conservative and that typical ratios for advanced secondary WWTPs range from 3.0 – 3.5. Since the ultimate CBOD to $CBOD_5$ ratio of 5.3 is significantly higher than typical ratios for highly treated WWTP effluent, and since it represents the highest value obtained, we request that a greater number of sample results be considered for increased statistical validity in selecting the ratio used.

To this end, the City of Franklin took the composite samples for October 1, 2, and 3, 2003 and split each with two independent testing laboratories for ultimate BOD testing. The average $CBOD_5$ of the samples is shown in the table below. Each lab split its respective samples three times for parallel tests. The ultimate BOD testing is based on Standard Methods for the Examination of Water and Wastewater, 20th Edition. The labs are measuring accumulated dissolved oxygen every five days during the test. Following are the measurements taken at day 20 of the test.

Date of Sample	Ave. $CBOD_5$ (mg/L)	Ultimate BOD: Franklin WWTP Lab (mg/L) (1)	Ultimate BOD: Environmental Science Lab (mg/L) (1)	Ultimate BOD: ELAB of Tennessee (mg/L) (1)
October 1, 2003	1.0	3.6	2.74	2.53
October 2, 2003	1.1	2.3	1.67	2.54
October 3, 2003	0.9	2.2	2.78	2.73 (2)

(1) Each result presented is the average of the three sample splits analyzed for that day.
(2) The value shown is the average for a 15 day BOD test.

The final results of the ultimate CBOD testing will not be available until after the public comment period for the TMDL has expired. We will submit the final results of the testing to EPA when they are complete. However, based on the 20 day measurements, a more reasonable ratio of ultimate CBOD to $CBOD_5$ for the Franklin WWTP effluent is 3.0. We request EPA consider using a ratio of 3.0 in the model to determine the WLA for $CBOD_5$.

3. Upon receipt of the draft TMDL, the City of Franklin immediately initiated the ultimate $CBOD_5$ testing discussed in Comment No. 2, above. Subsequent to the start of these tests, we received a copy of the Georgia Environmental Protection Division protocol for long term BOD tests. This protocol requires analysis of the BOD samples for a duration of 120 days in combination with analyses of nitrate-nitrogen and nitrite-nitrogen at specified intervals. It was confirmed with Mr. Mark Koenig of USEPA Science and Ecosystem Support Division that this methodology was utilized for the Franklin effluent samples analyzed by EPA during the development of the TMDL. This duration of testing is quite extensive and significantly exceeds standard test requirements used in the wastewater treatment industry. We respectfully request that EPA confirm the validity of using ultimate BOD test results obtained at a duration of 120 days relative to the actual hydraulic detention time of the affected section of the Harpeth River. The City of Franklin requests that if this methodology is required, that additional time be provided to complete additional tests. We also request that the EPA provide a summary of the previous test results for informational and comparison purposes.

4. The waste load allocation (WLA) of 290 lbs/day of total nitrogen (TN) for the Franklin WWTP appears in several places in the draft TMDL report and is discussed on page 52. The total allowable load for TN in the lower section of the river was developed using the method discussed in Appendix G. The method used to calculate the required load reduction is presented in

Appendix H. The loads and percent reductions are listed in Tables 15 and 16 (page 37). The report states that the three WWTPs are projected to discharge 336 lb/day total and that these numbers are based on data in Table 10. Table 10 refers to Table 25, which is the table at the end of the allocation section stating the WLA for the wastewater treatment plants. It is not readily apparent how the value of 290 lb/day was developed. We believe the WLA was developed by applying the current annual average concentration for TN measured in the WWTP effluent (2.9 mg/L as indicated in Table 9, Summary of Discharge Monitoring Reports, page 26) to the design flow rate of 12 million gallons per day (mgd). Later in the same paragraph the report states that the plants are "currently operating close to advanced wastewater treatment performance levels of 4 mg/L $CBOD_5$, 1 mg/L ammonia, and 5 mg/L total nitrogen".

It is noted that Table 25 has a discrepancy in the calculation of total nitrogen. The report test indicates that the total from the three WWTPs is 336 lbs/day. However, if the total nitrogen allocations for Franklin, Lynnwood and Cartwright WWTPs are added, the total is 326 lbs/day. Second, a total nitrogen of 290 lbs/day is indicated for the Franklin WWTP, but the corresponding concentration is listed at 3.0 mg/L. However, 290 lbs/day at 12 mgd corresponds to 2.9 mg/L. A similar situation is noted for the Cartwright facility.

The TN limit listed in the Franklin WWTP NPDES permit is a monthly average concentration of 5 mg/L and a seasonal (May 1 – October 31) average loading of 377 lbs/day. The TN loading limit is based on the 99th percentile concentration of TN (5.65 mg/L) and the 99th percentile of flow (8.00 mgd) discharged to the Harpeth River. The commonly accepted limit of technology for effluent TN is considered to be 3.5 mg/L by some states, and not less than 3.0 mg/L nationwide. We are not aware of any WWTP in the United States or elsewhere that is required to meet a limit of less than 3 mg/L, and those that do have a limit of 3 mg/L are normally regulated on an annual or 12-month rolling average basis.

It is noted that the 12 mgd permitted flow for the Franklin WWTP represents an annual average. Therefore some months will see average flows of greater than 12 mgd while others are lower. The TN loading limit in the NPDES permit was incorporated as a seasonal average to accommodate maximum month flows. We have tabulated the month to annual average flow ratios from 1996 through 2002 (see attached Table 1). Many of the months with high ratios occur in the winter and spring. However, there are some occurrences of high ratios in the summer months. As an example, we applied the month flow to annual average flow ratios for 2000 to an annual average flow of 12 mgd (within the data set, the year 2000 represents a summer season with moderate flow variation). The total nitrogen discharged in lbs/day was calculated for effluent TN concentrations of both 3.5 and 3.0 mg/L. Table 2 lists the pounds that would be discharged for each month under this condition. It is clear that under flow conditions similar to these, that the nitrogen allocation of 290 lbs/day would be extremely difficult for the Franklin WWTP to meet, even if regulated on a seasonal average basis.

The TN loading limit included in the Franklin WWTP NPDES permit is based on established statistical methods and is reasonable based on available denitrification technologies. We request your consideration of including a TN load of 377 lbs/day for the Franklin WWTP in the TMDL. If a lower nitrogen allocation must be considered, we request that other point and non-point sources be requested to further reduce nitrogen prior to requiring the Franklin WWTP to meet a limit that is lower than the limit of technology.

We hope you will consider the draft TMDL modifications requested by the City of Franklin. During the last two years, we worked closely with the Tennessee Department of Environment and Conservation to ensure that our wastewater plant renovation project would meet the requirements that were incorporated in the

NPDES Permit issued in February, 2002. It is essential that close coordination continue if the City of Franklin is to meet it's commitment to protect the Harpeth River, while also being prudent managers of our resources. As you consider the comments that we have presented, we welcome the opportunity to continue our discussions and to respond to your questions, such that the end result is fair, accurate, and reasonable to all. If you have any questions concerning our comments, please do not hesitate to call. Your consideration of these modifications is greatly appreciated.

Very truly yours,

BLACK & VEATCH

Roger D. Lindsey
Project Manager

cc: Jay Johnson, City of Franklin
Eddy Woodard, City of Franklin
Vic Bates, City of Franklin
Saya A. Qualls, TDEC
Tom McGill, USEPA
Shannon Lambert, B&V
Chris deBarbadillo, B&V
Beth Quinlan, B&V

TABLE 1

Franklin, TN WWTP
Ratio of Month Flow to Average Flow

Month	1996	1997	1998	1999	2000	2001	2002
January	0.77	1.10	0.88	***1.83***	0.73	0.88	1.13
February	0.90	1.07	0.91	***1.38***	0.95	1.39	0.95
March	1.14	***1.64***	0.83	***1.55***	0.97	0.99	1.52
April	1.09	0.87	***1.20***	0.87	***1.51***	***0.85***	***1.23***
May	1.19	1.05	0.94		***1.33***	***0.64***	***0.96***
June	1.14	***1.51***	***1.21***	0.87	0.99	0.97	0.67
July	0.97	***1.32***	1.05	0.80	0.93	0.85	0.71
August	0.91	0.56	0.81	0.68	0.97	0.90	0.70
September	0.91	0.53	0.89	0.77	0.91	0.86	0.82
October	0.83	0.72	0.97	0.66	0.75	0.98	1.00
November	1.00	0.82	0.97	0.75	0.98	0.83	1.02
December	1.14	0.81	1.29	0.80	1.00	1.68	1.27

TABLE 2

Franklin, TN WWTP

12 mgd Annual Average Flow

Pounds of nitrogen discharged for flows similar to 2000 monthly flow pattern

Month	2000 Flow Ratios	Month Flow if average = 12 mgd (mgd)	Pounds discharged if TN = 3.5 mg/L (lbs/day)	Pounds discharged if TN = 3.0 mg/L (lbs/day)
January	0.73	8.76	256	219
February	0.95	11.40	333	285
March	0.97	11.64	340	291
April	1.51	18.12	529	453
May	1.33	15.96	466	399
June	0.99	11.88	347	297
July	0.93	11.16	326	279
August	0.97	11.64	340	291
September	0.91	10.92	319	273
October	0.75	9.00	263	225
November	0.98	11.76	343	294
December	1.00	12.00	350	300
Seasonal Average without April			343	294
Seasonal Average with April			370	317
Annual Average			351	301

Tom McGil

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

October 28, 2003

Mr. Paul S. Gagliano
Tennessee TMDL State Coordinator
U.S. Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-8960

Dear Mr. Gagliano:

Thank you for your letter and enclosures of September 30, 2003, regarding informal consultation for the Proposed Organic Enrichment/Low Dissolved Oxygen Total Maximum Daily Load (TMDL) for Waters in the Harpeth River (Hydrologic Unit Code (HUC) 05130204). The identified impaired waterbodies include Beech Creek and an unnamed tributary to the Harpeth River (TN05130204009); Newsome Creek, Trace Creek, and Murray Branch (TN05130204009); West Fork Harpeth River, Caycee Branch, Polk Creek, and Kennedy Creek (TN05130204013); Rattlesnake Branch (TN05130204013); Harpeth River headwaters (TN05130204016); Arrington Creek, Spencer Creek, Watson Branch, Fivemile Creek, Lynwood Creek, and Starnes Creek (TN05130204016); Harpeth River headwaters, Concord Creek, Puckett Creek, Cheatham Creek, and Kelly Creek (TN05130204016); Harpeth River from the South Harpeth River to the Little Harpeth River (TN05130204009-2000); Harpeth River from the Little Harpeth River to the West Harpeth River (TN05130204009-3000); and the Little Harpeth River from the Harpeth River to Otter Creek (TN05130204021-1000). The impaired waterbodies of Bedford Creek and Arkansas Creek identified in the State's Section 303(d) list are not specifically referenced in this TMDL. The Harpeth River watershed is within Cheatham, Davidson, Dickson, Hickman, Rutherford, and Williamson Counties, Tennessee.

Narrative and numeric criteria promulgated by the State of Tennessee were found to be exceeded when the condition of the biological communities in impaired waterbodies in the Harpeth River watershed was measured using metrics equivalent to the Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-8-89-001) and compared against appropriately selected reference sites in the same ecoregions. This TMDL is comprised of three primary components: 1) watershed nutrient load reduction evaluations to address the water quality impacts in the tributaries; 2) an assessment of dissolved oxygen impacts of the upper mainstem of the Harpeth River; and 3) an assessment of dissolved oxygen impacts of the lower Harpeth River from river mile 88.1 to river mile 32.4.

In order for this TMDL to be established, numeric targets protective of the uses of the referenced waterbodies must be identified to serve as the basis for the TMDL. The TMDL establishes numeric ecoregion-based total nitrogen (TN) and total phosphorus (TP) criteria from a percentile from the distribution of primary variables of known reference systems. These nutrient variables include TN, TP, choraphyll a, and turbidity or total suspended solids (TSS). For the purposes of this TMDL, and in accordance with the standard for biological integrity, the 75th percentile values of TN and TP data collected at Tennessee's Level IV ecoregion reference sites were determined to be the appropriate numeric interpretation of the narrative water quality standard. The variable-derived concentrations and the average monthly flows of the tributaries are utilized to estimate the load allocation (allowable pounds per month) which would meet the numeric nutrient target. It is assumed that these reductions will decrease periphyton and algal growth, which will also decrease the observed variations in dissolved oxygen concentrations.

In the upper and lower reaches of the Harpeth River, various modeling techniques for determining sediment oxygen demanding materials (i.e., biochemical oxygen demand (BOD), ammonia nitrogen (NH_3-N), and dissolved oxygen (DO)) are utilized to estimate the wasteload allocation to meet the previous State dissolved oxygen criteria of 5.0 mg/l. This modeling is also utilized to predict potential impacts associated with National Pollutant Discharge Elimination System (NPDES) permitted facilities in the watershed. Although there are 19 NPDES permitted facilities evaluated in this TMDL, only 6 receive a specific waste load allocation. The State of Tennessee has recently adopted a revised minimum dissolved oxygen criterion of 4.0 mg/l in ecoregion 71i, the Inner Nashville Basin. The Tennessee Department of Environment and Conservation (TDEC) also authorized expansions of the City of Franklin and Lynwood Utility Wastewater Treatment Facilities (WWTFs) prior to TDEC or the U.S. Environmental Protection Agency (EPA) developing this TMDL. U.S. Fish and Wildlife Service (Service) personnel have reviewed the proposed TMDL and offer the following comments.

Historic endangered species collection records in the Harpeth River watershed exist for the Federally endangered dromedary pearly mussel (*Dromas dromas*), yellow blossom (*Epioblasma florentina florentina*), tan riffleshell (*Epioblasma florentina walkeri*), and catspaw (*Epioblasma obliquata*). Although we have no historic records, the Federally endangered Cumberlandian combshell (*Epioblasma brevidens*) may have also occurred in the watershed. The Harpeth River watershed has experienced significant degradation due to agricultural and urban development. There have been numerous extensive fish kills in the watershed as a result of the release of ineffectively treated wastewater.

Current endangered species collection records available to the Service do not indicate that Federally listed or proposed endangered or threatened species occur within the Harpeth River watershed. A Federal candidate species, the fluted kidneyshell (*Ptychobranchus subtentum*), and a species of concern, sheepnose (*Plethobasus cyphus*), are known to presently exist in the Harpeth River watershed. The Service recently prepared a candidate elevation package for the sheepnose. We note, however, that collection records available to the Service may not be all-inclusive. Our data

base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. We encourage EPA to assimilate the most recent biological data collected in the Harpeth River watershed and determine whether survey efforts for Federally listed species have been adequate to establish their presence or absence in the impaired waterbodies. Additional survey efforts may be warranted.

The modeling associated with the calculation of load allocations for TN and TP utilizes average annual flows in the Harpeth River tributaries. During critical low flow periods, the actual loading of nutrients associated with organic enrichment is likely substantially higher, especially during storm events. Since TSS and chloraphyll a values are not utilized in the modeling procedures, we believe a more conservative approach is needed to obtain the required load allocations for TN and TP in the watershed. Additional modeling for TSS would also appear to be technically feasible and warranted. We would encourage EPA to re-model the load allocations based on measured monthly or seasonal critical minimum flows in the impaired tributaries.

Pursuant to Chapter 1200-4-3-.05(4) of Tennessee's General Water Quality Criteria, all other criteria, including nutrient criteria under the fish and aquatic life use, shall be applied on the basis of stream flows equal to or exceeding the 30-day minimum 5-year recurrence interval. Although an evaluation of 7Q10 flows in the watershed is referenced in the appendices for this TMDL, critical low flows measured at the U.S. Geological Survey gauging station at the Highway 46 bridge have, on many occasions, been below 0.5 cubic feet per second (CFS). We would expect tributary flows to be substantially lower. The methods for calculating the load allocations in this TMDL may not be consistent with guidance contained in 40 CFR §130.32(7).

The same modeling deficiencies are apparent for waste load allocations for sediment oxygen demanding (SOD) materials. Based on the contribution to flow within the Harpeth River watershed that the effluents of many of the wastewater treatment facilities have during critical low flow periods of record, we are concerned with the definitive statement that these facilities were determined not to cause or contribute to violations of water quality standards for the segments addressed by this TMDL. That is contrary to a later statement that the City of Franklin WWTF contributes approximately 10% of the SOD in the reach below their effluent outfall. It is estimated that the City of Franklin WWTF effluent may comprise approximately 80% of the base flow of the Harpeth River below the effluent outfall. When the City of Franklin WWTF reaches it's approved expansion limit of 12 million gallons per day (MGD), the effluent could comprise over 90% of the base flow in the Harpeth River during critical low flow periods of record. Definitive data regarding water withdrawals above the effluent point sources may not have been included in the model as well. We do not concur that these facilities are independent of sub-watershed drainage area and occurrence of storm events. If these calculations are indeed indicative of current critical low flow conditions in the watershed, then there exists no unallocated assimilative capacity in the mainstem which precludes an adequate margin of safety (MOS) from being implemented pursuant to 40 CFR §130.32(8) and (9).

The monthly average five-day Carbonaceous Biological Oxygen Demand ($CBOD_5$) NPDES permit limits at the various NPDES permitted facilities identified in this TMDL are utilized. We believe a more conservative approach would be to utilize the daily maximum $CBOD_5$ NPDES permit limitation for the individual WWTFs modeled at critical low flow conditions. At least for the tributary systems, it appears that the 7Q10 flows utilized in the model were higher than the measured flows during an August 2000 study. Modeling conducted in the mainstem may not have adequately reflected critical low flow conditions.

In a July 31, 2000, correspondence from EPA to TDEC, EPA recommended that the State adopt ambient water quality criteria for ammonia based upon EPA's updated 1999 guidance. This was a priority in the last triennial review of the State's water quality standards. Since the State did not adopt that criteria and the NH_3-N criterion exists in EPA's recommended water quality criteria, we believe that additional modeling for NH_3-N is also technically feasible and warranted. The EPA-recommended criteria were recently utilized in an ammonia/organic enrichment/low DO TMDL developed by TDEC for Eagle Creek. We believe that the concentrations of NH_3-N present in the effluents of the WWTFs in the watershed also have direct applicability to the nitrogen loading issues discussed above in the watershed.

The Service has been actively involved in researching the toxicity of ammonia to Unionid mussels and sensitive fish species. It should be noted that the NH_3-N criteria established in the 1999 Update of Ambient Water Quality Criteria for Ammonia (USEPA 1999) is not as protective as alternative criteria recently developed by the Service. At a pH of 7.51 SU and temperature of 25.28°C, EPA's recommended criterion continuous concentration (CCC) is 2.16 mg/l and the criterion maximum concentration (CMC) is 19.6 mg/l. Our research has resulted in alternative recommended chronic ammonia guidelines of approximately 0.3 to 0.7 mg/l total ammonia as nitrogen at a pH of 8 SU. This range is similar to ammonia values derived in other independent research. In North Carolina, the Service utilized an approach where the upper 90th percentile of pH values in a target waterbody was used in calculating an alternative criterion for that specific pH value. Due to the apparent potential minimal densities and diversity of sensitive Unionid mussel and fish species in the Harpeth River watershed, we believe that additional evaluation of ammonia toxicity issues in the watershed is warranted.

We are also concerned that this TMDL does not identify all of the potential sources of organic enrichment and sediment oxygen demanding materials associated with permitted facilities which receive coverage under the State's NPDES general permit programs. For example, sites in the watershed with coverage under the State's NPDES stormwater permit program are not identified. We must assume that these facilities would receive a waste load allocation of zero, but there is no data to suggest that is the case. There is one Class II concentrated animal feeding operations (CAFOs) NPDES general permit facility (i.e., Harlin and Sumners Dairy) located in an impaired waterbody and this facility was assigned a waste load allocation of zero. This facility is authorized, however, to discharge during chronic rainfall events. No discharge monitoring data for this facility

was provided in the TMDL. We are not aware that specific effluent limitations for theses facilities have ever been implemented in the respective State's general NPDES permits. The deficiencies associated with the Source Assessment (page 19) for this TMDL should be corrected.

Since many of the sub-watersheds in the Harpeth River basin are also impaired due to siltation/habitat alteration and facilities covered under the State's NPDES general permit program are not routinely required to utilize sediment detention or treatment structures, this oversight substantially reduces the stated conservative assumptions associated with the estimation of waste load allocations for sediment oxygen demanding materials. It also likely reduces the stated conservative assumptions regarding load allocations for TN and TP due to the potential input of water soluble nutrients from unidentified agricultural and silvicultural operations, as well as water soluble nutrients applied to unidentified disturbed construction areas to enhance revegetation efforts. Since the modeling procedures are based on an estimated geometric mean of annual nutrient loading, any MOS should also reflect storm event inputs for the sources and these sources should be modeled at critical low flow periods of record, instead of average flows.

For those operations that do utilize such structures, we question the ultimate effectiveness of stormwater detention or treatment structures designed to handle 2-year, 24-hour precipitation events in the current NPDES stormwater general permit program. Stormwater detention basins designed to handle a 10-year, 24-hour event, or greater, would provide a more appropriate level of protection. We are also not aware of any requirements for the use of treatment chemicals or sediment flocculants being imposed on these facilities.

Under EPA's revised new source performance standards (40 CFR Chapter 1, §434.63), Effluent Limitations for Precipitation Events, existing best available control technologies recommended by EPA for coal mining operations indicate that a criteria of 0.5 ml/l (maximum, not to be exceeded) for total settleable solids is achievable. Additionally, TDEC personnel involved in the coal mining regulatory program have indicated that a level of 0.1 ml/l may be more protective for sensitive species. A total settleable solids effluent limit of 0.08 ml/l was recently included in a NPDES permit for a coal mining operation in the State. Any effluent limitation for total settleable solids should be based on a peak discharge, not an arithmetic average or geometric mean.

Although the specific numeric NPDES permit limits for TSS for the identified facilities covered under an individual NPDES permit discussed in this TMDL were not provided, other NPDES permits in the State authorize discharges of TSS levels in the range of 40 mg/l to 50 mg/l (weekly average or daily maximum). Lower limits are specified in the State's regulations for discharges to water quality limited/effluent limited stream segments. A correlation between TSS levels and total settleable solids (when measured by the gravimetric method) may exist. We believe that a substantial reduction in pollutants, whether originating from a defined point source or from non-point sources, can only be accomplished through implementation of a site-specific control program that utilizes best available control technologies for the capture and treatment of stormwater and sediment.

There were no specific data regarding the number or nature of aquatic resource alteration permits (ARAPs) or construction projects (e.g., unauthorized gravel dredging) that are not permitted included in this proposed TMDL. The TMDL also failed to include a narrative regarding compliance evaluations performed by TDEC for discharge monitoring reports required under currently authorized NPDES permits, or a discussion of current monitoring and enforcement activities in the Harpeth River watershed.

Many of the referenced individual NPDES permits, the Nashville/Davidson County Municipal Separate Storm Sewer System (MS4), the proposed Phase II MS4s, and the Tennessee Department of Transportation MS4 contribute significant stormwater discharges to the Harpeth River watershed. According to EPA's 1991 national guidance for TMDL development, if a point source NPDES permit limit is based on a waste load allocation that relies on non-point source load reductions, then the NPDES permit record is to include: (1) reasonable assurances that needed nonpoint source controls will be implemented and maintained, or (2) a monitoring program to demonstrate the nonpoint source load reductions. Assurances may include local ordinances, grant conditions or other enforceable conditions. We would appreciate additional information on how EPA or the State will implement these requirements.

We are concerned that the 19 identified NPDES discharges in the impaired waterbodies may not be in compliance with 40 CFR §122.4(I) and 40 CFR §131.10. We believe that in some cases, for discharges into 303(d) listed waters, sites currently permitted under the State's NPDES general permit program may need to obtain coverage under an individual NPDES permit in order to meet the pollutant reduction goals outlined in this TMDL. Our interpretation of existing Federal regulations indicates that a new discharge(s) which contributes additional pollutant loading into 303(d) listed waters should be precluded.

We are not aware of a routine monitoring program (i.e., sample collection and analysis) in place to evaluate the effectiveness of various best management practices (BMPs) associated with existing NPDES individual and stormwater general permits and ARAP permits issued by TDEC. NPDES permits may need to provide for more stringent limits on the point source if expected nonpoint source load reductions are not demonstrated. We are not certain that the sensitivities of all aquatic organisms, including listed species, were considered in the development of this TMDL. Due to the known distribution of Federally listed species in other major Cumberland River tributaries, we believe that additional evaluations of the water quality and habitats in the Harpeth River watershed are necessary.

Until such time that a comprehensive review of the NPDES and other regulatory programs in the Harpeth River watershed is completed, we recommend that a moratorium on the issuance of Aquatic Resource Alteration Permits, Section 401 Water Quality Certifications, NPDES individual permits, and stormwater construction general permits in the impaired waterbodies be implemented. Since BMPs for controlling erosion associated with agricultural and silvicultural activities in the watershed

are strictly voluntary and no regulatory mechanisms currently exist to control these discharges, we believe that this TMDL, as proposed, will fail to achieve it's desired numeric target levels within two years.

Although it may be preferable to rely on voluntary, incentive-based mechanisms to achieve the desired improvements to water quality in the impaired waterbodies, we believe that the State of Tennessee and EPA should consider an administrative review of the effectiveness of existing voluntary programs designed to control erosion in the impaired waterbodies, and consider additional regulatory mechanisms to achieve the desired TMDL targets. We encourage EPA to develop a specific monitoring plan and implementation schedule for this proposed TMDL. Specific monitoring and implementation methodologies have not been included in the previous TMDLs we have reviewed in Tennessee.

Within the framework of our Memorandum of Agreement (MOA) Regional Review Team, we would like to discuss the applicability of utilizing alternative existing criteria developed for activities outside the scope of those NPDES discharges discussed in this TMDL. We strongly encourage EPA to re-evaluate existing NPDES individual permits, stormwater general permits, and aquatic resource alteration permits in place within the Harpeth River watershed to ensure compliance with existing Federal regulations.

We would like to work cooperatively with the State of Tennessee and EPA in prioritizing critical treatment areas in these impaired watersheds, while leveraging available funding from our agencies to correct the identified problems. We believe that this TMDL could be enhanced with a thorough evaluation of existing land uses and management practices in the impaired watersheds and ecoregional reference sites, as well as implementation of the technical recommendations outlined above.

These constitute the comments of the U.S. Department of the Interior in accordance with provisions of the Endangered Species Act (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.) and the Memorandum of Agreement between the U.S. Fish and Wildlife Service, Environmental Protection Agency, and National Marine Fisheries Service. Thank you for the opportunity to comment on this action. If you have any questions, please contact Steve Alexander of my staff at 931/528-6481 (ext. 210) or via e-mail at *steven_alexander@fws.gov*.

Sincerely,

for Lee A. Barclay, Ph.D.
Field Supervisor

xc: John Hefner, FWS, Atlanta
Bill Starkel, FWS, Atlanta
Joe Johnston, FWS, Atlanta
Duncan Powell, EPA, Atlanta
Grail Mitchell, EPA, Atlanta
Tom McGill, EPA, Atlanta
Paul Davis, TDEC, Nashville
Dave McKinney, TWRA, Nashville

Barry Sulkin
<sulkin@bellsouth.net
>

11/26/2003 07:00 PM

To: William Melville/R4/USEPA/US@EPA

cc: Rick Parrish <rparrish@selcva.org>

Subject: Harpeth DO TMDL comments

To: Bill Melville, EPA
From: Barry Sulkin
Re: Harpeth River DO TMDL Comments

November 26, 2003

Bill,

As we now understand the plan, EPA is coming to Tennessee next Thursday, December 4, 2003 for a meeting with various interested parties regarding the Harpeth River DO TMDL. I plan to attend that meeting and provide input, both at the meeting and in subsequent written comments as needed. Obviously, we will be better able to provide meaningful comments after we meet and have time to digest additional information, however at this point we have only been officially given a deadline that was extended to the end of November. It is unclear how rigid that comment deadline is viewed by EPA, or if you plan to keep the comment period open for a time after we meet. With these uncertainties, we felt it best to at least provide some basic comments before the end of November, that we can hopefully and logically modify after we meet. However we did not want to let the noticed deadline pass as things now stand.

Therefore, on behalf of the various environmental groups represented by the Southern Environmental Law Center, I have been asked to send this correspondence to get some of our basic comments in the record, with the understanding that this is only a brief mention of some of the primary items of concern. While it is appreciated that a great amount of fine work has gone into this effort, and there appears to be the basis for a good final product, at this time we find this to be lacking in some significant ways, and thus not acceptable as a TMDL as per our reading of the federal requirements.

In the interest of brevity, at this time our comments will only be given in the form of what we find lacking in this TMDL, and will not cover all issues or details.

1. Lack of Daily Maximum Loads and permit limits for DO-related pollutants - monthly and annual averages are not acceptable, consistent with criteria, or supported. This includes nutrients that are only evaluated as annual loads - while this may be partly justified in some cases for lakes, this is a flowing river for which an annual load alone makes little sense.

2. Lack of correlation to sediment TMDL of last year - which we also commented on and found to be unacceptable and, in fact not actually a TMDL as per the regulations.

3 Lack of any proposed permit limits for most of the point sources - i.e. municipal and industrial/construction storm water permits.

4. Allowing continuation of existing permit limits for most of the permits that currently have limits, with the presumption that in-stream capacity will be made available through significant reduction of SOD and sediment inputs from currently non-limited sources (see item 3 above).

5. Minimal reduction to Franklin's permit limits based apparently only on monthly average, not daily maximum assessment, and presumption of available in-stream capacity form SOD/sediment input reductions with no assurance of implementation; and no reconsideration given to last year's significant expansion of Franklin's permit prior to TMDL completion.

6. No reduction, and even an increase in load from Lynwood STP, ignoring previous studies in 1998 showing impacts from before expansion; again apparently based on a presumed but unsupported future reduction in SOD/sediment input.

7. No correlation clearly given for the relationship between the DO-consuming parameters of SOD, BOD, ammonia, N & P to show how it all balances to determine the safe carrying capacity of the river, allowable loads, and permit limits.

8. Lack of documentation to support claim of verified model or level of uncertainty upon which to base accuracy and margin of safety.

9. Apparent lack of correlation with Franklin water withdrawal and proposal to increase withdrawal in near future - before standards are met in the river, thus potentially causing further impacts.

10. Lack of clarity on SOD/sediment reductions - are these to be reductions of existing in-stream loads, existing/future inputs, both?

SUMMARY

It is anticipated that upon discussions next week and further evaluations, some of these issues may be explained and perhaps eliminated from our concerns, others will embellished, and others will be added. However, at this point, in general the underlying concern is that the current TMDL proposal appears to be based on a vague presumption that somehow the existing and/or future sediment problems will be drastically reduced by 40 to 65%, and thus allow business as usual for the permitted dischargers. There is no indication how this drastic reduction will take place, especially if no new permit limits or restrictions on new sources are planned for the storm water sources, and most all STPs get to keep their existing limits and expansion plans. Thus there is no reasonable assurance that this will or can be implemented or succeed.

A basic concept of the TMDL program as taught by EPA and the state over the past years is that it is a method to determine the safe carrying capacity of a waterway, and allocate portions of that capacity to various sources, leaving a margin of safety - but only if there is available capacity to allocate. If problems are caused by non-point sources, the points sources must be forced to cut back through permit limits or denials to within the capacity of the waters, and this will hopefully result in cooperation between point and non-point sources to fix the problems. Here it appears that the Harpeth River is currently beyond capacity, but STP sources are being allowed to

maintain most of their loads and previous expansion commitments regardless of currently available capacity. Further, there is no apparent plan to restrict new sources or allocate loads to and set limits for what appear to be identified as the primary sources of the loads that need to be reduced.

We hope that this provides some basic comments upon which we can build our discussions, future additional comments, and hopefully a revised and mutually acceptable TMDL product that we can agree fulfills the obligation of the regulations and the settlement agreement in TMDL suit.

HARPETH RIVER ASSIMILATIVE CAPACITY AT LYNNWOOD STP WILLIAMSON COUNTY, TENNESSEE NOVEMBER 1998

INTRODUCTION

Due to a proposed expansion of the Lynnwood Utility Corporation sewage treatment plant (STP) and concerns of pollution problems in the Harpeth River, the state Division of Water Pollution Control (WPC) conducted recent field investigations and computer modeling to assess the river's capacity to assimilate wastewater. This report summarizes the issues and findings regarding such work by the state WPC as well as additional field and modeling work conducted by the author and others. The primary questions are 1) whether the river is already impaired, 2) what are the causes of any problems, 3) how to assess the situation to determine of any additional sewage loads can be accommodated, and 4) what additional studies are needed.

BACKGROUND

The Lynnwood STP, built some twenty years ago, is currently designed to treat approximately 200,000 gallons per day (0.2 million gallons per day- mgd). It primarily serves the Cottonwood and Legends Ridge subdivisions and a school, and discharges to river mile (RM) 77.9 of the Harpeth River. This is just downstream (north) of the inflow from the West Harpeth River confluence at RM 78.1 and at the upstream end of the Lumsden Bend of the river as shown on the Leipers Fork topographic map (63 NW). Upstream about 7.3 river miles, the City of Franklin STP discharges at RM 85.2 at an estimated capacity of 6 mgd, with plans to double in the future.

There have been significant problems and permit violations at both the Franklin and Lynnwood STPs recently due to age and problems with equipment and operation combined with increasing flows from new connections. At the Lynnwood STP a plant improvement project was reportedly completed in August 1998 that was to make the plant capable of treating its currently permitted flow of 0.2 mgd. The permit now in question is for an expansion of the Lynnwood STP to 0.4 mgd primarily to accommodate a proposed new subdivision near the river.

In the summer of 1986, as a project for WPC and as a thesis for an Environmental Engineering Masters Degree at Vanderbilt University, an assimilative capacity and modeling study of the Harpeth River at Franklin was conducted ("Harpeth River Below Franklin Dissolved Oxygen Study", Sulkin, May 1987). At that time, the Franklin STP was permitted for 2.5 mgd and was discharging an effluent well within its limits. Findings from that study include:

1. Dissolved Oxygen (DO) levels in the river above and below the STP were at times below the standard of 5.0 mg/l, thus leaving no capacity for additional waste assimilation.

2. Primary factors other than BOD and ammonia in the STP effluent influencing the DO levels in the river were the high algal and sediment loads.

3. Nutrient inputs to the river contribute to the algal growth, with nitrogen compounds likely being the limiting factor.

4. The standard waste load allocation (WLA) computer modeling used by WPC did not adequately represent the Harpeth in this region and was not appropriate for determining assimilative capacity due to the fact that it does not account for sediment, nutrients, or algae - the factors that control the DO of this river.

The WLA model used by WPC is a simplified Streeter-Phelps DO calculation of the removal of DO due to BOD and ammonia decomposition, and DO reaeration due to turbulence and mixing. As routinely used, it does not account for sediment, nutrients, or algae, nor is it calibrated to match field data or actual river characteristics to any extent. In cases where the WLA model is found to be inadequate and/or where field data are to be used, a more sophisticated model such as the QUAL2E model used in the Franklin study is needed if valid predictions are desired.

A study of the Lumsden Bend reach of the Harpeth similar to the Franklin study, has not been done. However this river section is likely similar to the Franklin reach except for the inflow of the West Harpeth River with what is presumed to be relatively clean water with a low algal and sediment content. If the West Harpeth water is significantly clean, algae-free, and of great enough volume, at low flows its influence upon the Harpeth downstream could be enough to change the DO dynamics. If the influence of the West Harpeth is of little consequence to the Harpeth, then the impacts of sediments, nutrients, algae, and the STP flows from Franklin and Lynnwood would continue to dominate the system and a similar situation would exist with low DO swings, and where the standard WLA model would not be suitable for assessing the river.

RECENT FIELD INVESTIGATIONS

To try and determine the condition and appropriate way to model the Lumsden Bend reach of the Harpeth for the proposed Lynnwood STP permit, some limited field investigations were conducted in August 1998 by the author, and in September 1998 by WPC. Despite a regionally dry season, flows in the Harpeth had been very high previous to these field investigations as recorded at the USGS gage at Highway 96 in Franklin upstream of the Franklin STP, where the low flow (3Q20) at this station is 0.36 cfs. Some of the recorded flows leading up to the field studies taken from the USGS readings as given on their web site are shown in Table 1.

TABLE 1
HARPETH RIVER FLOWS
FRANKLIN USGS GAGE - HWY 96
AUGUST - SEPTEMBER 1998

Date	Flow (cfs)	
8/14/98	700	
8/17/98	200	
8/19/98	60	
8/21/98	40	
8/26/98	14	DO profile float
8/28/98	25	
8/30/98	22	
9/1/98	7.5	
9/2/98	4.4	
9/3/98	6.3	WPC field survey
9/4/98	13	" " "
3Q20 low flow	0.36	

On August 26, 1998 an early morning DO profile float was conducted through the Lumsden Bend reach to try and determine the DO profile. The float started at RM 79.8 at the Cotton Road bridge just below the inflow of Lynnwood Creek, about 1.7 miles above the West Harpeth confluence. We began before sunrise at 5:45 AM to try and catch the low points of any diurnal DO cycle. Upstream of the STP the DO readings were in the range of 5.7 to 6.2 mg/l, with a reading of 6.8 mg/l in the West Harpeth at its mouth. Below the STP the lowest reading was 5.4 mg/l at 7:42 AM at about RM 75.7 at a stone boat dock on the lower end of Lumsden Bend. The water appeared murky and olive green with very low clarity that appeared to be related to algae and suspended solids. In contrast, the West Harpeth water was clear, but this resulted in no noticeable change in the Harpeth below the confluence.

On September 3-4, 1998 WPC conducted a field study that consisted of flow measurements, chemical and biological sampling, and a 24-hour hydrolab data recording for DO, conductivity, pH, and temperature at two stations in the Harpeth - one each above and below the Lynnwood STP. Harpeth River flows on this occasion were measured by WPC on the first day as shown in the Table 2. It should be noted that these values are from actual measurements, not the USGS gage, and they were made several miles below the gage after the inflow of STPs and tributaries along the way, thus they cannot be compared directly to the gage values shown above.

TABLE 2
HARPETH RIVER FLOWS
SEPTEMBER 3, 1998

Location	Flow (cfs)
RM 79.8 @ Cotton Rd.	13.5612
RM 78 above STP below West Harpeth	29.7866
RM 75.7 below STP @ lower Lumsden Bend	30.1848

The 24-hour recorded data showed that above the STP at RM 79.8 the DO rose at night from about 5.9 mg/l to 7.25 mg/l as the temperature dropped and the pH slightly rose. Below the STP at RM 75.7 (at the stone boat dock) the opposite swings were seen with the DO dropping at night from 8.5 mg/l to about 5.5 mg/l while the temperature dropped and the pH dropped slightly. This indicated that above the STP the DO cycle was typical of a temperature driven system with lower DO at lower temperatures, and below the STP the DO was dominated by algae, with respiration at night causing a lower DO despite reduced temperatures, and the lower pH due to the influence of carbon dioxide given off during the respiration phase in the dark hours acting as a weak acid.

Between the hydrolab recording stations there were only two changes in the Harpeth of significance to the observed data. One is the inflow of the West Harpeth at RM 78.1 with clean water that would tend to lessen the influence of algae. The other is the effluent from the Lynnwood STP at RM 77.9 that would tend to add nutrients and DO depleting components and fuel the growth of algae. These data reveal that the STP is having an adverse impact on the river DO that is not off-set by the inflow of the West Harpeth.

Data from samples taken by WPC on September 3, 1998 and from the operation reports filed by the STP showed that the effluent at the time of this survey was very low in BOD and ammonia, with values reported as (less than or equal to): 1.0 mg/l BOD and 0.1 mg/l ammonia. The DO data observed thus represent the DO dynamics of the river 1) at flows greater than the low flow basis for the permit, and 2) with STP effluent BOD and ammonia well below average and maximum permitted levels. WPC samples also showed significant levels of suspended solids and nitrogen compounds being discharge from the STP as compared to the permit limit (for solids) and levels in the river upstream. The sample results for these parameters are given in Table 3.

TABLE 3
NITROGEN & SOLIDS (mg/l)
SEPTEMBER 3, 1998

Location	RM 79.8 Cotton Rd.	RM 78 U/S STP	(RM 77.9) STP Effl.	RM 77.8 D/S STP	RM 75.7 Lumsden	Permit Limit (daily max)
NO2+NO3	2.52	1.32	24.0	2.60	1.38	none
Sus. Solids	0	0	84*	28	88	45

(* permit violation)

The data in the above tables show that even under non-critical conditions the river is experiencing DO swings down to within 0.5 mg/l of the water quality standard, and that the STP is the apparent cause of this impact. This is likely due to the oxygen depleting components of the wastewater along with the nutrient content of the effluent fueling algal growth downstream of the STP, which results in DO consumption during the respiration cycle.

Other information beyond the recent chemical/physical data described above add more to the knowledge of the state of the Harpeth in this area. During the WPC field study of September 3-4, 1998 benthic biological data were collected. These data were later analyzed by a biological consultant and found to demonstrate an impacted community upstream of the Lynnwood STP with further impacts downstream (see McFadden, November 9, 1998). The Tennessee Wildlife Resources Agency (TWRA) also recently collected fish samples in the Harpeth. Their only station near this reach is just upstream of the West Harpeth, and it showed a low abundance (catch rate) of all sportfish (see Fisheries Report No. 98-8, Region II 1997, June 1998). TWRA plans to do additional fish sampling in the coming year and may include the Lumsden Bend reach. Finally, residents living along the Harpeth in the Lumsden Bend area report foul odors coming from the river in recent years. These odors have been described as musty and resembling sewage. Some residents report that they no longer fish in the area nor use the river for recreation due to the lack of game fish and the unsightly appearance and odors.

WASTELOAD ALLOCATION MODELING

To assess the impacts of the STP and proposed expansion on the DO of the river, WPC ran the standard WLA model. Copies of these runs were obtained from WPC and are dated August 31, 1998, thus data from the September 1998 field survey were not taken into account. The WLA

model was run using standard assumptions for rates of DO removal and reaeration, and did not account for any sediment or algae impacts.

With standard WLA modeling, usually no attempt is made to calibrate the model to match field conditions. The monthly average STP discharge limits are used as inputs to the river, and daily maximum values are not considered. This can be of great significance, since the daily maximum limits are double the average values, are allowed by the permit on a daily basis, and are what the river actually "sees" and has to assimilate when such concentrations of waste are discharged. If the model of average limits shows a DO sag to at or near the minimum DO standard of 5 mg/l, then in a marginal situation such as in this case (medium to small water quality limited river), unless the WLA model is reasonably accurate and has an adequate margin of safety (such as showing a minimum DO sag to 2 mg/l above the standard), it may not be of great value in determining proper permit limits for protecting the river.

The WPC WLA model run for assessing the proposed permit expansion to 0.4 mgd calculated a DO sag below Lynnwood of 5.265 mg/l. An examination of the model output actually shows this to be no sag at all, since it calculates an increasing DO upstream of the STP that continues to increase downstream, so the first calculated value below the STP is the lowest value. This implies that the STP at the proposed expansion flow and average limits has no impact on the river. As seen from the field data discussed above, this is obviously not the actual case.

To further assess the permit for this report, first the state's exact WLA model was used with the daily maximum limits for BOD and ammonia for the existing Franklin STP and proposed Lynnwood STP to try and simulate what would be allowed by the permits on a given day at low flow. The model then calculated a DO sag below Lynnwood to 2.82 mg/l indicating a violation of the stream standard for DO.

Next, data from the Lynnwood STP monitoring reports and from the field work by WPC in September 1998 was used to try and calibrate the WLA model to some extent to better match the real river. Here the model was started above the Lynnwood STP at the upstream hydrolab station, and the West Harpeth flow was treated as a discharge. Using the measured flows for September 3, 1998 (somewhat greater than 3Q20), and knowing that the river has a significant sediment load, the Sediment Oxygen Demand (SOD) component of the model was used to adjust for the algal respiration phase DO consumption and matched the calculated DO to the 5.5 mg/l measured value at RM 75.7 as closely as possible. With this semi-calibrated model, additional model runs were made using several scenarios, with the results as given in Table 4.

TABLE 4
HARPETH WLA MODEL RUNS

Model Run	DO Sag (mg/L)
Lynnwood @ proposed 0.4 mgd w/ average permit limits @ 9/3/98 river flows	4.95
Lynnwood @ proposed 0.4 mgd w/ maximum permit limits @ 9/3/98 river flows	4.91
Lynnwood @ proposed 0.4 mgd w/ average permit limits @ low flow	2.69
Lynnwood @ proposed 0.4 mgd w/ maximum permit limits @ low flow	2.49

While the above runs are not fully calibrated nor verified models and other assumptions and variations could be used, it is clear that the standard WLA model ignores actual field data, uses only average discharge values, does not assess maximum allowable concentrations, and assumes no impact from sediments, nutrients, or algae. The semi-calibrated modeling described above, while not exact, does more closely represent the actual river conditions observed . Clearly, in this reach of the Harpeth River these additional factors are of major significance and should be accounted for in setting permit limits to protect the river.

The State of Tennessee and EPA established a formal agreement on WLA procedures at least as far back as 1982 ("State/EPA Region IV Agreement on the Development of Wasteload Allocations and Wastewater Permit Limitations", 1982). This agreement, which appears to stand essentially unchanged today, sets out basic principles regarding how WLA's are to be done. In general this agreement establishes methods for determining permit limits such as 1) empirical models - the standard WLA model using assumed values, 2) calibrated models - models using some level of field data, and 3) verified models - use of field data tested and adjusted under varying conditions to match predictions with actual field conditions.

The acceptable procedure is to use standard assumptions in the absence of field data, but where actual field data are available it is to be used. Unless the standard assumption values have changed in a more recent version of the agreement, background conditions are to be set as 2 to 3 mg/l for BOD (as CBOD) and 0.5 to 1 mg/l for ammonia (as NBOD). In the WLA done by WPC in August of 1998, field data had not been collected, so the modeling was strictly empirical with

all assumed values, but the background conditions used were 1.5 mg/l for BOD and 0.1 mg/l for ammonia, which are lower than the values in the agreement, and would result in higher calculated in-stream DO values. The September 1998 field study provided limited data, however it was enough to demonstrate that the standard WLA model was inaccurate and not applicable to this situation. Thus far, it appears that no additional modeling has been done by WPC to try and incorporate available data and information to create a calibrated model that more accurately resembles the actual river conditions and protects uses and standards. Further, the agreement appears to require (on page 5) that for situations with more stringent levels of effluent BOD (given as 10 mg/l), the empirical model in not acceptable, and states:

"Where the above constraints prohibit use of empirical models, some level of calibrated or verified model must be established for wasteload allocation purposes."

CONCLUSIONS AND RECOMMENDATIONS

Recent field studies, data evaluations, and reports by residents living along this section of the Harpeth River have thus far revealed some findings that include:

1. The river's minimum DO below Lynnwood at lower flows is controlled and dominated by algal respiration.
2. At low flows and currently allowed maximum permitted wastewater limits, the discharge from the Lynnwood STP, and the resultant DO sag due to decay of BOD and ammonia, and diurnal cycles of algae, the DO standard of a minimum of 5.0 mg/l DO is likely not being maintained.
3. The standard WLA method for modeling this river is inappropriate and not adequate for making predictions for permit expansions.
4. If the proposed expansion is allowed as planned, the algal and DO problems are likely to worsen and DO standard violations become more frequent due to increased loadings of pollutants from the STP combined with likely increased loadings of sediment and related pollutants from induced construction runoff the expansion is designed to accommodate.
5. In its present state, the river appears to be impaired and not meeting criteria in terms of sediments/solids, nutrient enrichment, turbidity/color, and odor.
6. In its present state, the river appears to be not supporting classified uses in terms of recreation and fish and aquatic life.

In order to adequately determine how much the river is impaired and to what extent the present STP discharge is adversely impacting the river, additional study is needed. To determine what, if any additional capacity this reach of the river has for waste assimilation, more accurate modeling and field verification are needed that account for nutrients, algae, and sediments, and more closely matches the actual river conditions.

The best opportunity to assess and protect this river is while there are heightened interest from all sides, and before a decision is made that will allow a plant expansion and resultant land development with sewage flow increases that cannot be reversed. Nitrogen compounds have not been limited in this or other STP permits in Tennessee, but it appears that such limits are now needed for NO2, NO3, and perhaps phosphorus, as BOD and ammonia limits cannot go much further, and nutrient enrichment problems as seen in the Harpeth are likely getting worse.

Before a decision is made regarding an expansion of the Lynnwood STP, it is recommended that a model capable of handling all the issues of concern - algae, nutrients, sediments, BOD, ammonia - be used. The model should use actual field data to the extent possible, and be calibrated/verified to better determine the present status and impacts, and more accurately predict the results of any expansions. Such an effort, which is already required and presumably being pursued for the Franklin reach as part of the 303(d) TMDL watershed assessment program, could and should be extended to include the Lumsden Bend reach. This assessment and modeling effort needs to be made prior to expansion permitting, or the problems are likely to get worse and be even more difficult to correct once expansion commitments are made to dischargers.

Prepared by:

Barry Sulkin
Environmental Consultant
4443 Pecan Valley Rd.
Nashville, Tennessee 37218
(615) 255-2079

Tom McGill 3.13

(UNDATED)

HRWA/CRC HARPETH RIVER WATERSHED SEDIMENT STUDY

Dorene A. Bolze, Richard E. Lockwood, and David J. Wilson
The Harpeth River Watershed Association
and
The Cumberland River Compact

1. Introduction

Sediment has been identified by State of Tennessee 305(b) and303(d) reports as having a major impact on water quality in the Harpeth River watershed and generally in the Cumberland River Basin. Construction activities tend to generate suspended sediment in streams. Increased imperviousness in the surface of a watershed results in increased flash-flooding, which results in stream bank and bed erosion. Excessive sediment interferes with the survival of fish and other aquatic organisms, causes a loss of habitat diversity, and disrupts the food chain. Deposition of sediment in quiescent portions of a river raises the level of its bed, resulting in increased flooding. High concentrations of sediment interfere with the operation of drinking water treatment plants. A high concentration of sediment often indicates stream bank erosion, with associated damage to streamside property. It also indicates loss of valuable topsoil in the watershed through erosion.

The Cumberland River Compact (CRC) and the Harpeth River Watershed Association therefore decided to do a study on mobile stream sediments. The Harpeth River watershed was selected for study because of its convenient location, the rapid development occurring in parts of the watershed, the presence of four gaging stations and lots of bridges in the watershed, and the existence of a data base on this watershed (the CRC's map and brochure) which could be used in planning the effort.

2. Objectives

The project's first objective is adult public education with regard to protection of riparian (streamside) vegetation and erosion control, such protection to be accomplished through best management practices in

agriculture, on construction sites, in stormwater management by municipalities, and by homeowners in the watershed.

A second objective is to provide useful data on stormwater transport of sediment levels TDEC, the TN Dept. of Agriculture's Nonpoint Source Program, the U.S. Army Corps of Engineers, the U.S. Geological Survey, and other agencies. The State of Tennessee will be required to submit Total Maximum Daily Loads for sediment in the state's streams within the next two years or so. These data should be useful in the development of those standards.

A third objective is to get information about the factors affecting sediment dynamics. The study will give us a good idea of which subwatersheds are showing the most sediment movement, and when and where major changes are occurring in sediment mobilization. This information can then be correlated with land use and management practices. Such studies can also permit us to make rough estimates of the quantities of sediment being discharged from a watershed like that of the Harpeth River.

3. Project Organization and Methods

At the TAS meeting last year I reported on our plans to carry out the study. The project has proceeded pretty much on schedule, and today I'd like to give a progress report on muddy waters in the Harpeth River and its tributaries.

The number and locations of the sampling sites, while scattered widely across the watershed, have been determined primarily by where we have been able to recruit volunteers. Most erosion and sediment transport occur during and shortly after significant rains, with the period during which the water in the stream is rising being of particular importance. This requires that much of our sampling be scheduled by rainfall occurrence, rather than by dates and times set in advance by us for our convenience. This, in turn, requires that sampling sites be located in the close vicinity of the volunteers doing the sampling.

Five stations in the Turnbull Creek watershed have been added to our set of sampling sites during the last few months because of the

controversy surrounding the construction of the I-40 - SR-840 interchange near Dickson. Previously we had only one station on Turnbull Creek, at West Kingston Springs Road. The project now has a total of 45 stations at sites scattered throughout the Harpeth River watershed.

Sampling on the smaller streams is triggered by approaching storms, as indicated by weather reports or weather radar. In this way, we can be sure of catching the rising branch of the hydrograph, which is especially important. (This is when the stream carries the bulk of the sediment.) On the lower reaches of the main stem of the Harpeth, on the other hand, the rising branch of the hydrograph may be delayed by roughly 10-20 hours or more, so one has more time to prepare to sample from sites at these locations.

Volunteers log the date and time of the sampling, the weather, the rain gage reading, the stream stage at the site (height of water), appearance of the stream, and the turbidity as measured by a turbidity tube. Samples showing high turbidities are submitted to Rick Lockwood or me for the determination of TSS. I also run turbidities on these samples for QA/QC purposes. Data are submitted to me by e-mail or fax, and are managed in an Excel 97 spread sheet.

4. Results and Conclusions

As of October 17th, 2001, the project has collected a grand total of 689 turbidity measurements at our 45 stations. Table 1 shows the average (arithmetic mean) turbidities for all stations having seven or more measurements as of August 1--a total of 34 sites. (Two sites which cannot be sampled under flood conditions were omitted.) The arithmetic mean turbidities show an enormous range--from less than 1 m^{-1} for Slickrock Branch (a near-pristine stream) to over 16 m^{-1} for the Harpeth River at Moran Road. Stations on the Harpeth, Little Harpeth, and West Harpeth Rivers tend to yield quite high results. The South Harpeth is substantially cleaner. Two stations on Turnbull Creek downstream from the I-40 -840 interchange construction have been in operation long enough to have enough data to calculate meaningful averages; both show evidence of excessive sediment. The data for any one station tend to be strongly non-normally distributed, so non-

parametric tests such as the Wilcoxon rank sum test must be used for comparing data sets. A large number of statistically significant differences between streams is being found.

On the basis of these data from the first year of the project, one concludes that the Harpeth River, Flat Creek (a tributary to the Harpeth in Bellevue), and the Little Harpeth River are most heavily contaminated with suspended sediment. These are followed by the West Harpeth, Lynwood Creek, and Turnbull Creek, which show substantial contamination. Slickrock Branch, Newsom Branch, Leipers Fork, Copperas Creek, and Talley Branch provide a reference baseline; these streams appear to be in near-pristine condition with regard to sediment.

The above results indicate that our dirtiest streams appear to be carrying roughly ten times the sediment concentrations found in our clean streams. Presumably this is due to construction/development activities with little or nothing in the way of Best Management Practices for sediment control, degradation of streamside vegetation buffers, and stream bed and bank erosion resulting from flash flooding. The flash flooding, in turn, occurs in watersheds in which a substantial portion of the watershed is impervious to water (roofs, streets, parking lots, etc.), resulting in extremely rapid runoff after storms.

One of the objectives of this study is to explore the relationship between turbidity and total suspended solids, which seemed to be well approximated by a single straight line in our early work. This conclusion was based on results on the Harpeth River at Highway 100, the Little Harpeth at Vaughn Rd, the South Harpeth at South Harpeth Rd, and Garrison Creek near Leipers Fork. For individual stations we continue to find excellent linear correlation between turbidity (T) and Total Suspended Solids (TSS), as illustrated by Rick Lockwood's results for Garrison Creek and mine for the Harpeth River at Highway 100 in Bellevue (Figs. 1 and 2).

However, we now have additional sites with sufficient turbidity and TSS data to warrant interpretation. Least squares linear plots of TSS (vertical axis) versus T are shown in Fig. 3 for the six sets of data for which we have sufficiently many data pairs to warrant

interpretation. Note that the slopes for the Harpeth River at Moran Road and for Turnbull Creek (combined stations at Cliffside and W Kingston Springs Rd) are substantially smaller than the slopes for the other four plots. I have QA/QC'd enough of these results to be convinced that these differences are not due to variations among the volunteers. The T versus TSS plot for all our data pairs is shown in Fig. 4, and shows a good deal more scatter and a significantly poorer coefficient of determination r^2 than we find for data from a single station.

Evidently there are significant variations in sediment characteristics from site to site--theory suggests smaller particle sizes at the Harpeth at Moran Rd and at the Turnbull Creek sites than at the other sites. The effect of particle size on the relationship between turbidity T and total suspended solids TSS is shown in Eq. (1).

$$TSS(mg/L) = 2.303 \frac{4d}{3} \frac{1}{\langle 1/r \rangle} T(1/m) \qquad (1)$$

Here d is the density (g/cm) of the minerals composing the sediment, r is the effective radius of a sediment particle (microns, millionths of a meter), <1/r> is a volumetric average of 1/r over all the sediment particles, and T is the turbidity as measured with one of our turbidity tubes. This result, unfortunately, introduces some uncertainty into the use of turbidity data in calculating total suspended solids concentrations unless site-specific calibration curves are prepared. This cautionary warning may be one of the more useful things to come out of this study, as turbidity tube measurements are used extensively by environmental groups.

5. Future work

The sediment study has now been under way for a little over a year. Data collection will continue until next fall, at which point a technical report on the project for the specialist and a nontechnical summary report for the general reader will be prepared. These will include statistical summaries and comparisons, as well as a correlation of our sediment results with land use patterns in the various sub-watersheds of the Harpeth River, a phase of the project on which we

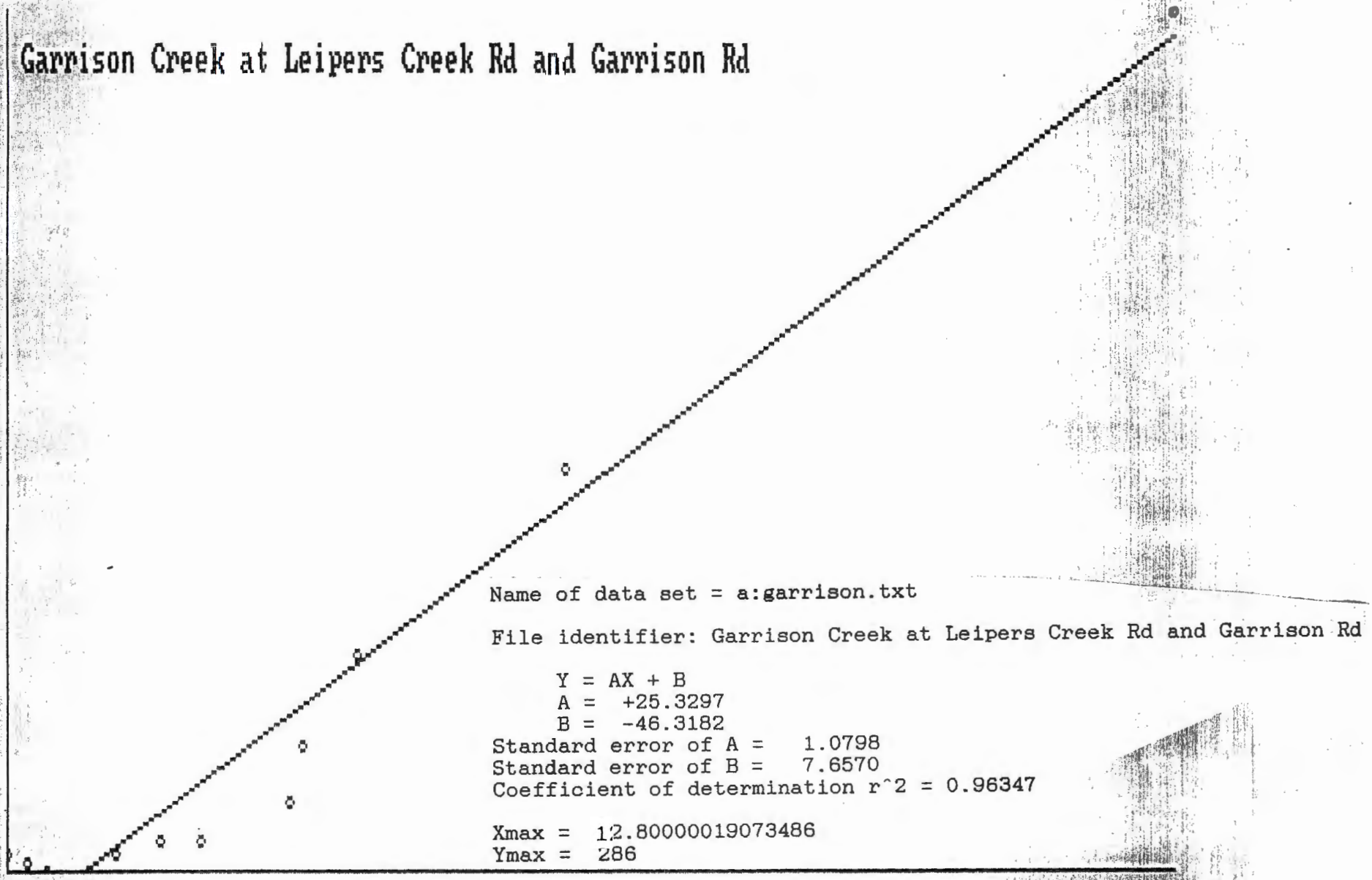
have not yet started. The project data file will also be made available for those desiring to use it.

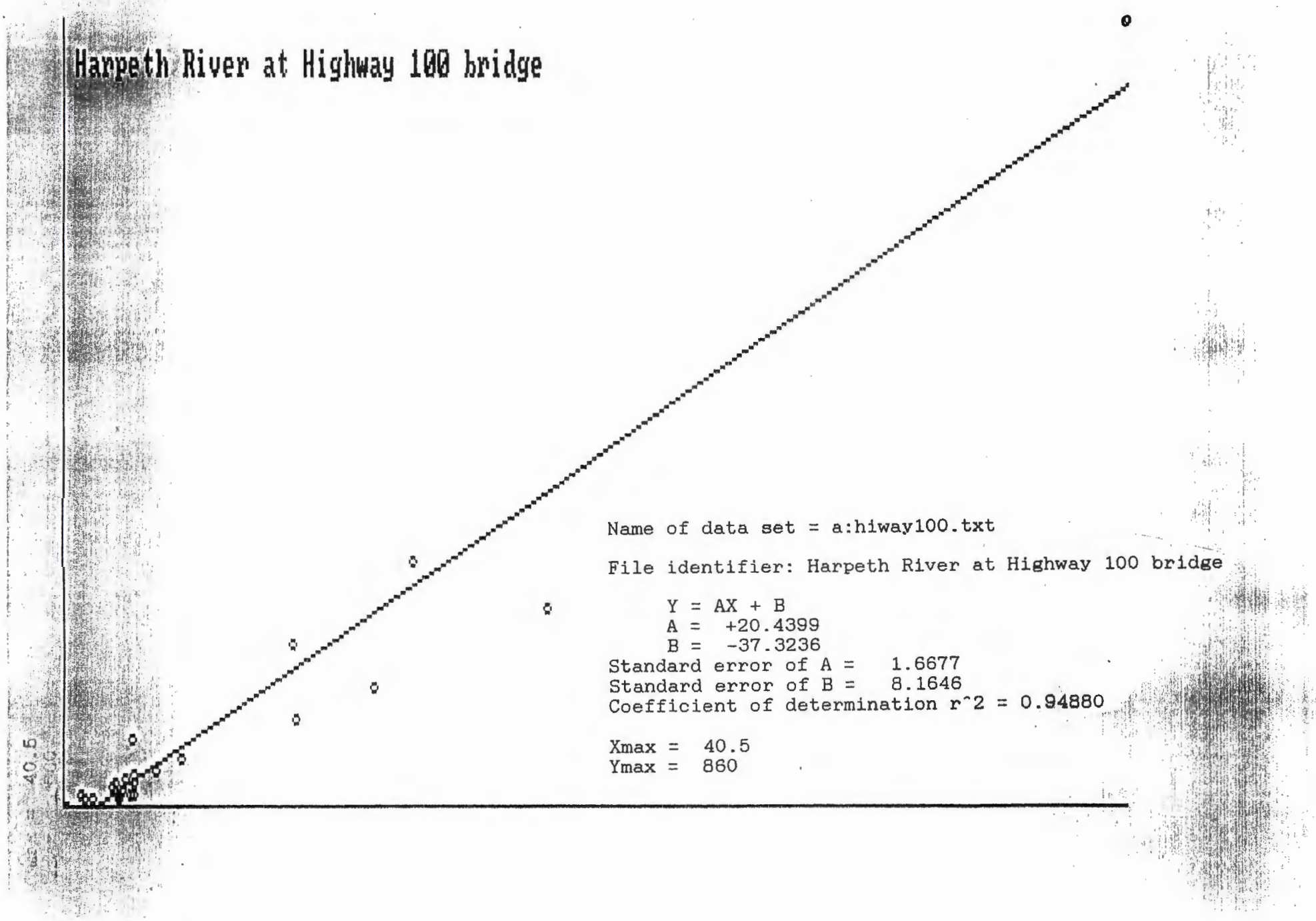
Table 1. AUGUST, 2001 RANKING OF STUDY STREAMS IN THE HARPETH RIVER WATERSHED ACCORDING TO INCREASING TURBIDITY

Station	Mean turbidity, 1/m
Slickrock Branch	0.87
Newsom Branch at Highway 70	0.94
Leipers Fork at Bailey Rd bridge	1.01
Copperas Creek	1.54
Talley Br in Kingston Springs	1.84
Vaughn's Cr at WPNC bridge	2.56
Kelley Creek	2.67
Murfrees Fork at Bear Cr Rd	3.14
Garrison Fork at Leipers Cr Rd	3.18
South Harpeth R at Highway 96	3.66
South Harpeth R at S Harpeth Rd	3.67
West Harpeth R at Highway 96	3.74
Sparks Creek at Mt Hope Rd	3.82
Murray Branch at Montpier Dr	4.90
Harpeth R at Pinkerton Park - 96	5.36
Harpeth R at Highway 100 bridge	5.51
Harpeth R at Harris St bridge	5.79
Cartwright Cr at Blue Springs Rd	6.05
Little Harpeth at Vaughn Rd bridge	6.37
Turnbull Cr at W Kingston Springs Rd	6.53
West Harpeth R at Southall Rd	6.58
West Harpeth R at Carters Cr Pike	6.84
Turnbull Creek at Cliff View	7.00
Harpeth R at 249 bridge W of Pegram	7.27
Lynwood Cr near confluence with Harpeth	8.03
Harpeth R at Cotton Rd bridge	8.81
West Harpeth R at Del Rio Pike	9.67
Harpeth R at Old Hillsboro Rd	11.34
Little Harpeth R S of Concord Rd	12.82
Harpeth R at Adams place, Pegram	13.11
Flat Cr at Old Hickory Blvd & 70 S	14.04

Harpeth R at Moran Rd bridge 16.54

Contacts: Dorene Bolze: doriebolze@home.com, (615)591-9095
Richard Lockwood: r.lockwood@adventgroup.org, (615)377-4775
David Wilson: djwilson@brwncald.com, (615)250-1248


Garrison Creek at Leipers Creek Rd and Garrison Rd
Name of data set = a:garrison.txt
File identifier: Garrison Creek at Leipers Creek Rd and Garrison Rd
Y = AX + B
A = +25.3297
B = -46.3182
Standard error of A = 1.0798
Standard error of B = 7.6570
Coefficient of determination r^2 = 0.96347
Xmax = 12.80000019073486
Ymax = 286


Harpeth River at Highway 100 bridge
40.5
Name of data set = a:hiway100.txt
File identifier: Harpeth River at Highway 100 bridge
Y = AX + B
A = +20.4399
B = -37.3236
Standard error of A = 1.6677
Standard error of B = 8.1646
Coefficient of determination r^2 = 0.94880
Xmax = 40.5
Ymax = 860

Least squares straight line slopes and intercepts for plots of Total Suspended Solids versus Turbidity

Turnbull Creek, six stations
TSS = (6.24 + 0.93)·T + (0.21 + 1.64)
18 samples, r^2 = 0.8615, corr. coeff. = 0.928

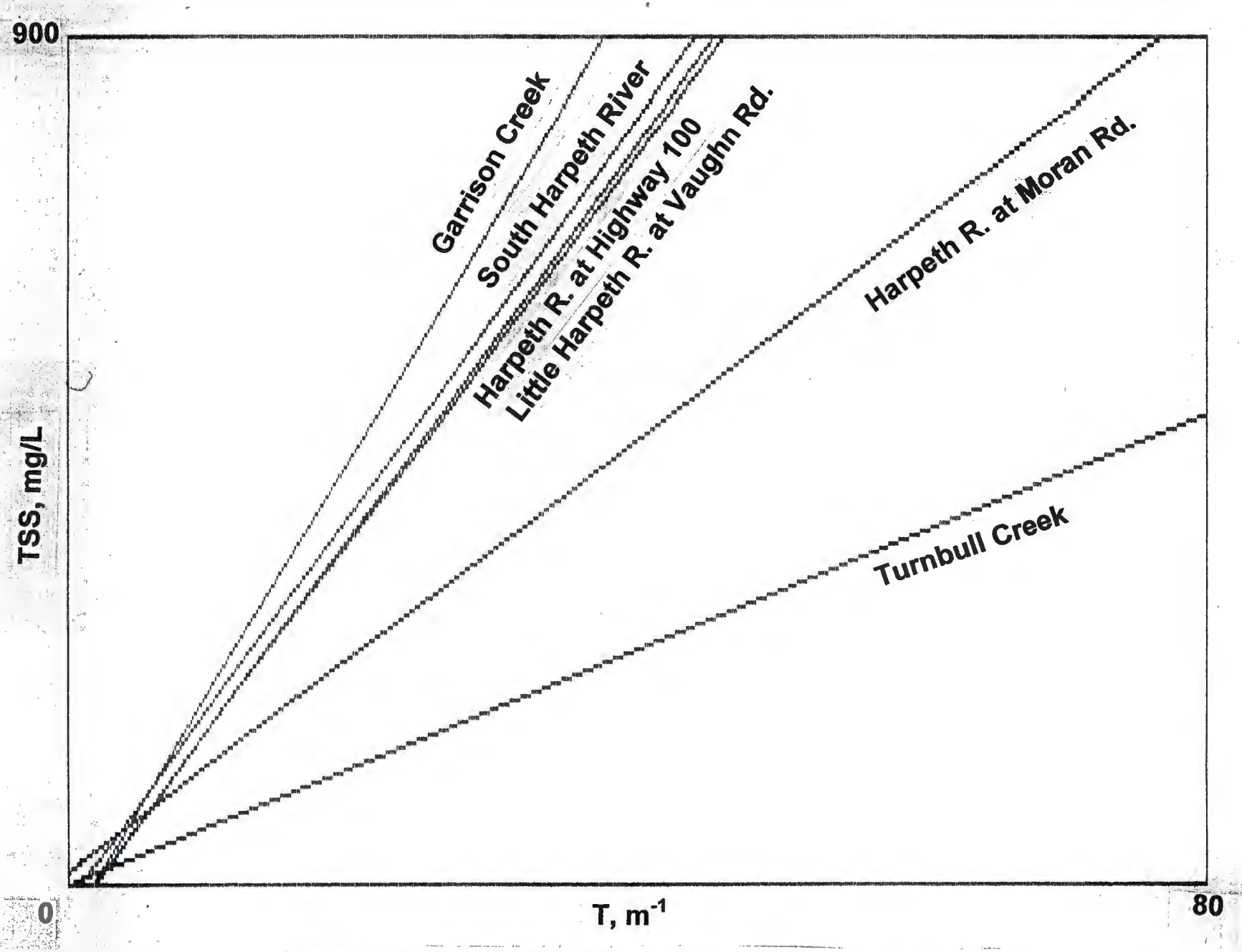
Harpeth River at Moran Rd. N of Franklin
TSS = (11.54 + 0.51)·T + (13.35 + 17.83)
10 samples, r^2 = 0.9742, corr. coeff = 0.987

Harpeth River at Highway 100
TSS = (20.44 + 1.67)·T – (37.32 + 8.16)
25 samples, r^2 = 0.9488, corr. coeff. = 0.974

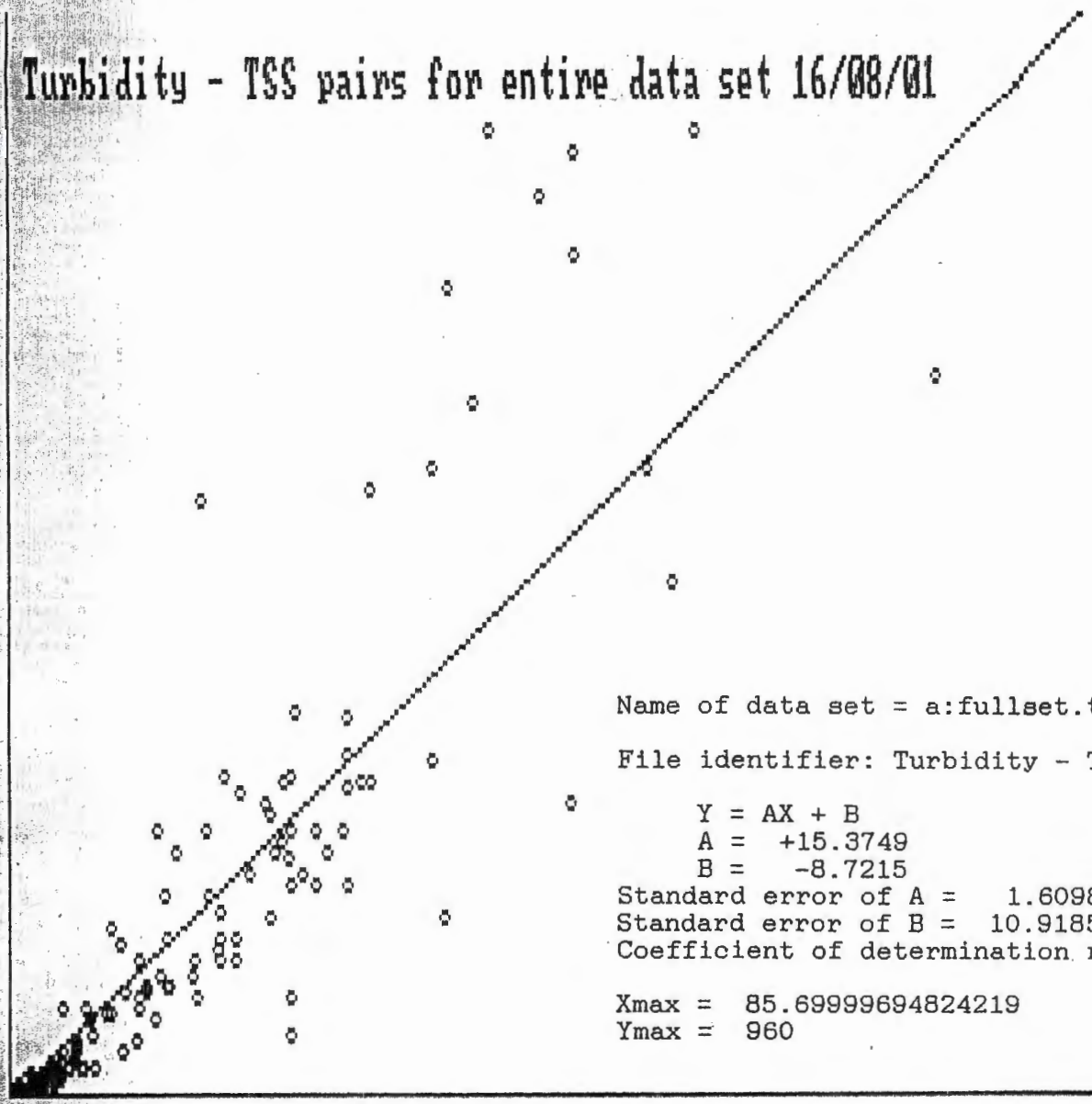
Little Harpeth River at Vaughn Rd., Warner Parks
TSS = (20.84 + 3.39)·T – (41.14 + 15.92)
24 samples, r^2 = 0.8775, corr. coeff. = 0.939

South Harpeth River at S. Harpeth Rd.
TSS = (221.02 + 2.08)·T – (20.99 + 6.44)
17 samples, r^2 = 0.9446, corr. coeff. = 0.972

Garrison Creek near Leipers Creek Rd.
TSS = (25.33 + 1.08)·T – (46.31 + 7.66)
11 samples, r^2 = 0.9635, corr. coeff. = 0.982



Least squares straight line plots of Total Suspended Solids versus Turbidity



Name of data set = a:fullset.txt

File identifier: Turbidity - TSS pairs for entire data set 16/08/01

Y = AX + B
A = +15.3749
B = -8.7215
Standard error of A = 1.6098
Standard error of B = 10.9185
Coefficient of determination r^2 = 0.78126

Xmax = 85.69999694824219
Ymax = 960